

INTERBUS-C

the industrial Bitbus





INTERBUS-C

the industrial Bitbus

As opposed to the upper floors of our factories where networking is progressing rapidly due to CIM, on the ground floor i.e. production a lot still has to be performed by foot. But how can this be changed?

Change it this way: use INTERBUS-C.

The INTERBUS-C (developed by Phoenix for a leading industrial computer manufacturer) is a serial data bus based on the Intel Bitbus which is due to be standardized. The SDLC/HDLC protocol of the 8044 Bitbus chip has an open character. Every INTERBUS-C product can be embedded even in non-proprietary Bitbus networks. This is very useful, as worldwide leading control, robots and computer manufacturers are in favor of the Bitbus.

The INTERBUS "C" stands for "Communication". In other words, it is not a simple data pump but a rather intelligent, open field bus for your CIM concept.

The design: A free slot of the (host or cell) computer accepts

the INTERBUS-C controller board; Phoenix offers a board for all IBM PCs and compatibles. – Even Digital Equipment Corporation decided in favor of the Bitbus and particularly the INTERBUS-C as a remote I/O for their VAX-computer systems and supports the IB-C-modules with DEC hardware and software.

Further, IB-C connects directly to Motorola VMEbus or Siemens SMP/AMS systems. Transmission is made from the host or control computer with a bus cable to local and remote destinations, if necessary, over more than 10 km. Wherever something has to be input or output, intelligent INTERBUS-C I/O modules are installed and connected directly to the bus cable.

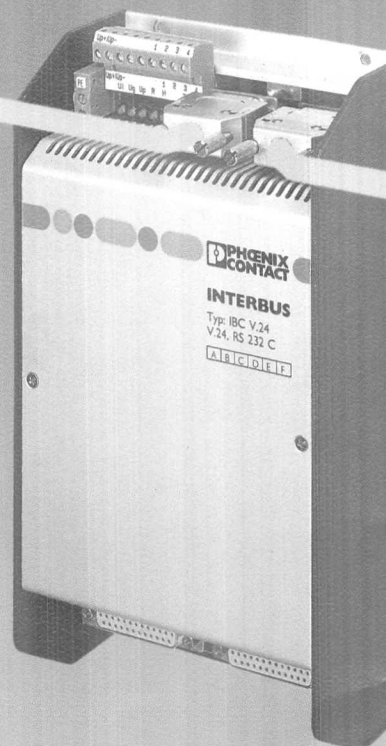
IB-C I/O modules are available for digital and analog input/output tasks or for direct connection to intelligent devices, such as screens, printers or controllers, via standardized interfaces. External device connection is effected via easy-to-service plug-in COMBICON screw terminal blocks using the

2-wire connection technique.

The INTERBUS-C not only communicates with simple sensors and actuators, but also transmits complete user programs from the host to the machine controls. It can be seen that the INTERBUS-C is suitable for production, process or heating, ventilation and air conditioning systems alike. This communication system can be extended at any time and it keeps wiring flexible. Once the IB-C bus cable has been laid you can connect an I/O module at any position.

INTERBUS-C, a standard field bus fitting well into the MAP concept.

For further information please refer to the INTERBUS-C manual or contact your local Phoenix sales office.





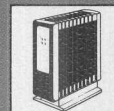
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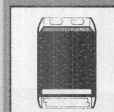
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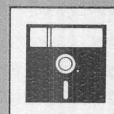
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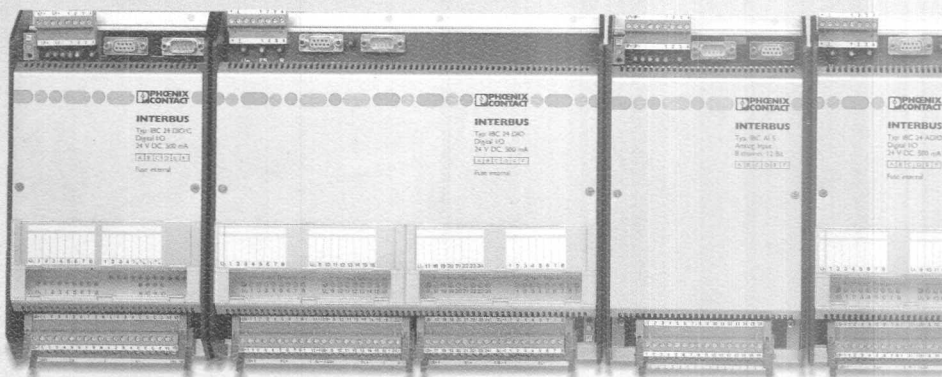
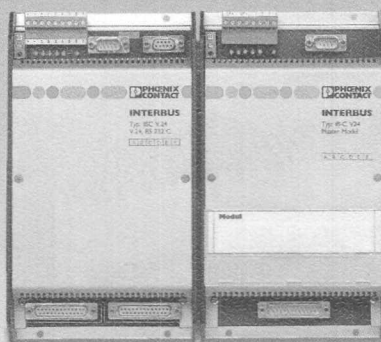
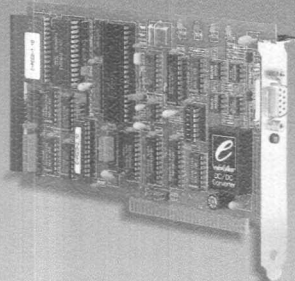
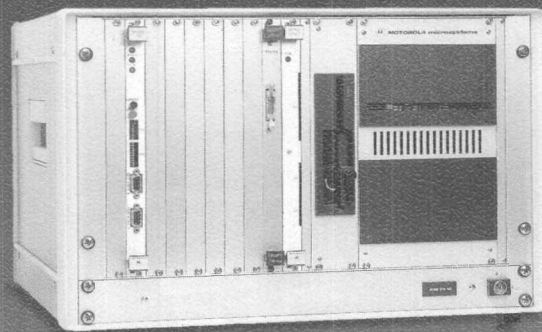


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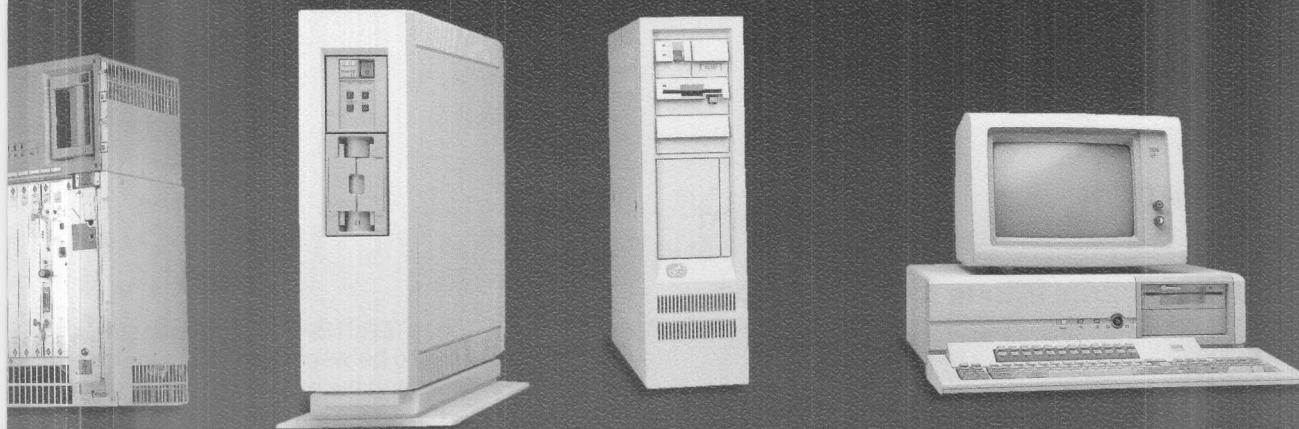
INTERBUS-C- Open for Everyone

INTERBUS-C, a product from PHOENIX, the Bitbus protocol is from Intel.

Within the "Factory of the Future" INTERBUS-C will be increasingly applied, for INTERBUS-C meets the trend towards decentralization and standardization in field wiring. With INTERBUS-C the user does no longer depend on other manufacturers – as you can find it with many other bus systems –, INTERBUS-C rather has an "open" character allowing future extensions. INTERBUS-C is supported by the most important computer manufacturers. – The use of the Bitbus compatible INTERBUS-C module range guarantees that the appropriate field bus product is applied for the individual system application required.

The INTERBUS-C modules comply with all electrical safety requirements demanded by IEC. The modules further transfer the distributed intelligence to the field – in close proximity to the sensors and actuators.

SIEMENS
SMP, AMS, OSM
intel
System 300
Multibus
IBM
IC, PC



INTERBUS-C

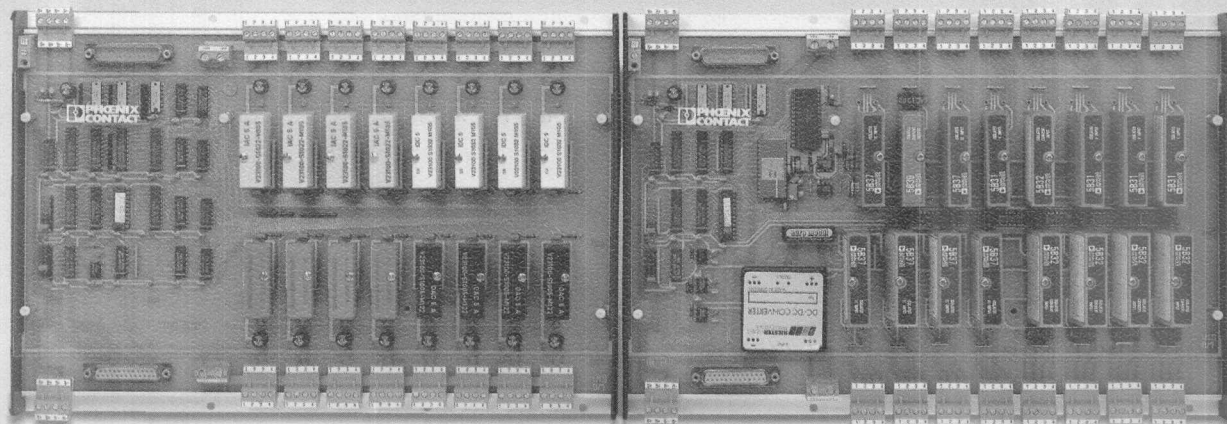
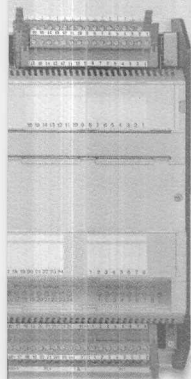
Links the Process Computer World
to the Process Periphery

digital

Micro-VAX

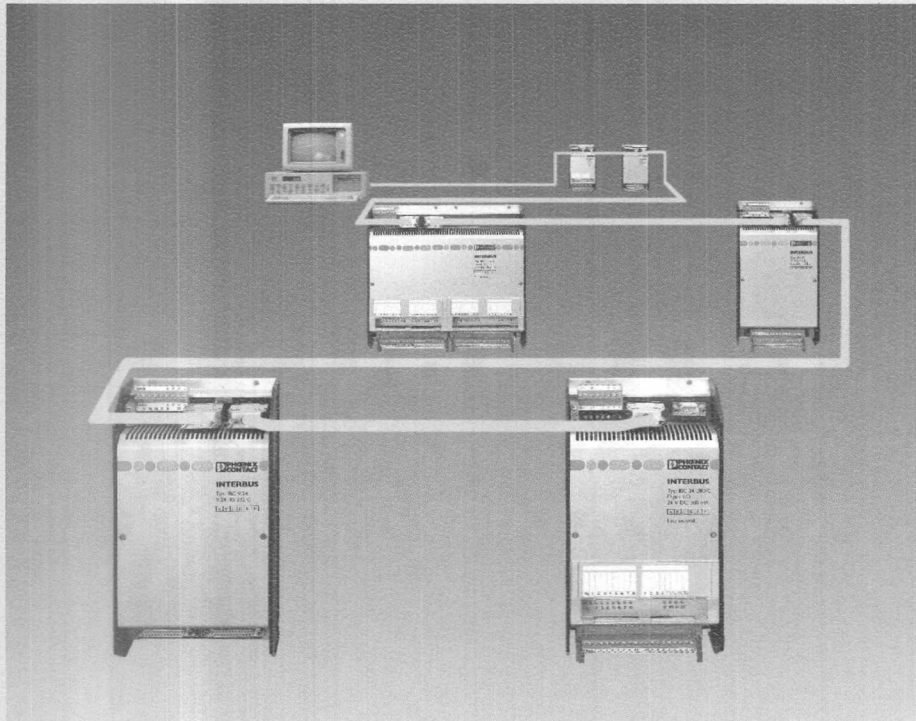


MOTOROLA
VMEbus



SYSTEM DESCRIPTION

INTERBUS-C the Industrial Bitbus for Automation



Within the entire automation a trend towards systems with "distributed intelligence" can be noticed. At the machine and process level where time-critical data of sensors and actuators are to be transmitted, a network with real-time features and open system architecture is required to achieve low-cost cabling.

Such a bus system for transmitting "short" field data is the Bitbus from Intel. This bus has already been accepted as a standard for all industrial control, monitoring and measuring transmission tasks. Its advantages: Flexibility and real-time ability.

INTERBUS-C uses the Bitbus standard and offers the first industrial Bitbus compatible I/O modules. The INTERBUS-C products have been developed to operate all Bitbus functions and establish local intelligence "on site" for extensions. Thus, INTERBUS-C can be used as a distributed periphery by different host systems. INTERBUS-C modules are designed in multilayer technique realizing a compact and space-saving installation as well as guaranteeing high reliability.

For the first time, INTERBUS even permits process systems with few I/O points to be decentrally controlled in an economic way. The INTERBUS-C modules are installed directly in the machine terminal boxes, the control console or on a display panel. Communication to the central host computer is made serially at high speed using a simple twisted wire pair and the standard Bitbus protocol.

Benefits of the INTERBUS-C:

- Reduced installation cost and cable routing.
- Intermediate terminal points and coupling levels are eliminated.
- Only one serial standard connection to the distributed INTERBUS-C-I/O modules covering distances of up to 13.2 km.
- Distributed intelligence to install high performance automation systems without overloading the central host computers.
- Safety at distributed intelligence by implementing an emergency-mode and enable output in all INTERBUS-C modules.

The INTERBUS-C modules are strictly isolated between periphery, microcontroller and the serial Bitbus interface. Comprehensive galvanic isolation provides high dependability and allows the connection to multi-user systems. No rack are required for mounting. The modules simply snap on the standard top hat rail. The I/O modules have a finely stepped expansion capability i.e. the user is capable of extending the inputs and outputs in very small steps. INTERBUS-C modularity assures an optimum adaption to nature and scope of the automation tasks to be solved.

For connecting sensors, actuators and intelligent I/O modules INTERBUS-C offers a comprehensive module range for

- binary I/O signals
- analog I/O signals and
- communication modules featuring standard V.24 (RS-232-C) interfaces.

The signal lines are connected using the convenient 2-wire or 3-wire connection method. All external terminations are pluggable to avoid line disconnection in the event of a module replacement. The INTERBUS-C communication interface module with two V.24 (RS-232-C) interfaces has been developed for direct I/O device connection, such as to CN-control systems, printers and computer terminals. This INTERBUS-C module offers open communication with standard interfaces.

To be able to set the INTERBUS-C modules to a defined state in the case of system interruptions, all modules feature an emergency mode with enable output. In the event of a network failure, time-out routines automatically set the modules to a state previously specified by the user. Standard functions, such as hardware and software watchdog as well as host-controlled diagnostic routines assure safe module operation.

In addition to electronics matched to industrial requirements and an exemplary housing design, the INTERBUS-C modules provide an open software structure. All modules use the 8044 Bitbus processor.

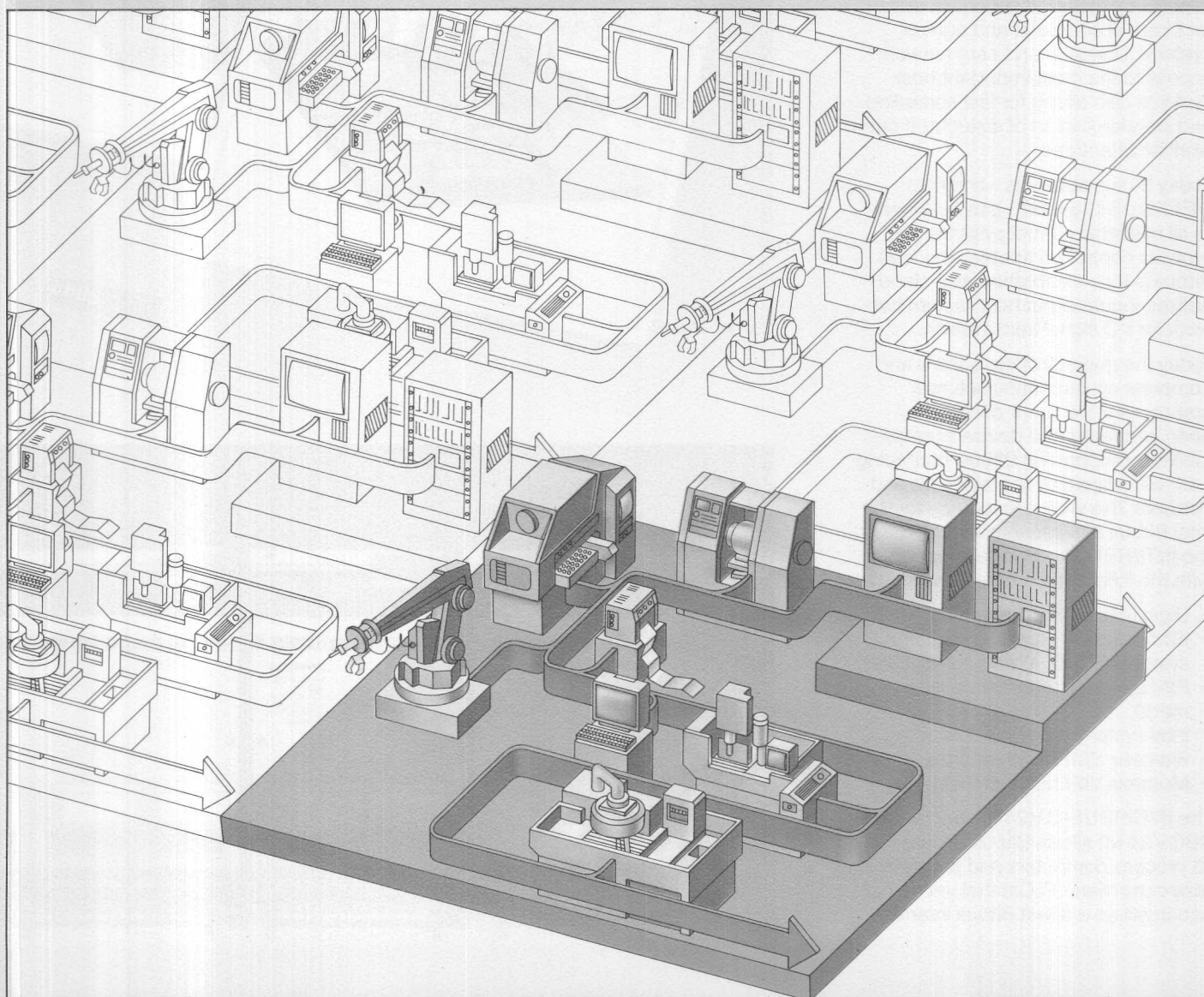
SYSTEM DESCRIPTION

The Intel DCX 51 real-time operating system has been implemented as firmware. The INTERBUS-C operates all Intel Bitbus functions. In addition, the user can harness the local module intelligence. For this reason, the firmware offers appropriate expansion capabilities in addition to the known Intel-RAC-commands. The modular firmware provides interfaces that allow user tasks to be implemented directly in the module. Intel offers worldwide

support with appropriate documentation and tools, thus allowing Interbus-C to become an open, flexible and cost-effective I/O system even suitable for systems house solutions.

Already today the INTERBUS-C products are adaptable to numerous standard computer systems, such as to Digital VAX-computers, IBM-PCs, Intel Multibus, Siemens SMP/AMS and

Motorola VMEbus systems etc. Thereby, the INTERBUS-C as a standard distributed I/O system is open for future expansions. – Well-known and important companies in the automation system field support the Bitbus standard. The Bitbus has already been submitted to the IEEE (P 1118) for standardization. This is the best prerequisite for realizing an open field bus concept.



SYSTEM OVERVIEW

INTERBUS-C – The Open Field Bus System for Process Computer Systems and Automation Equipment

The rigorous utilization of the Intel Bitbus allows INTERBUS-C to realize a standard interconnection between computer systems, robots, material handling systems, manufacturing and transfer lines, CNC-machine tools, process monitoring systems and their respective programmable controllers. The performance and the application possibilities of a field bus system are not exclusively determined by the following Bitbus network components, such as

- Intel Bitbus Chip,
- documentation and support tools available worldwide
- comprehensive distributed I/O module range etc.

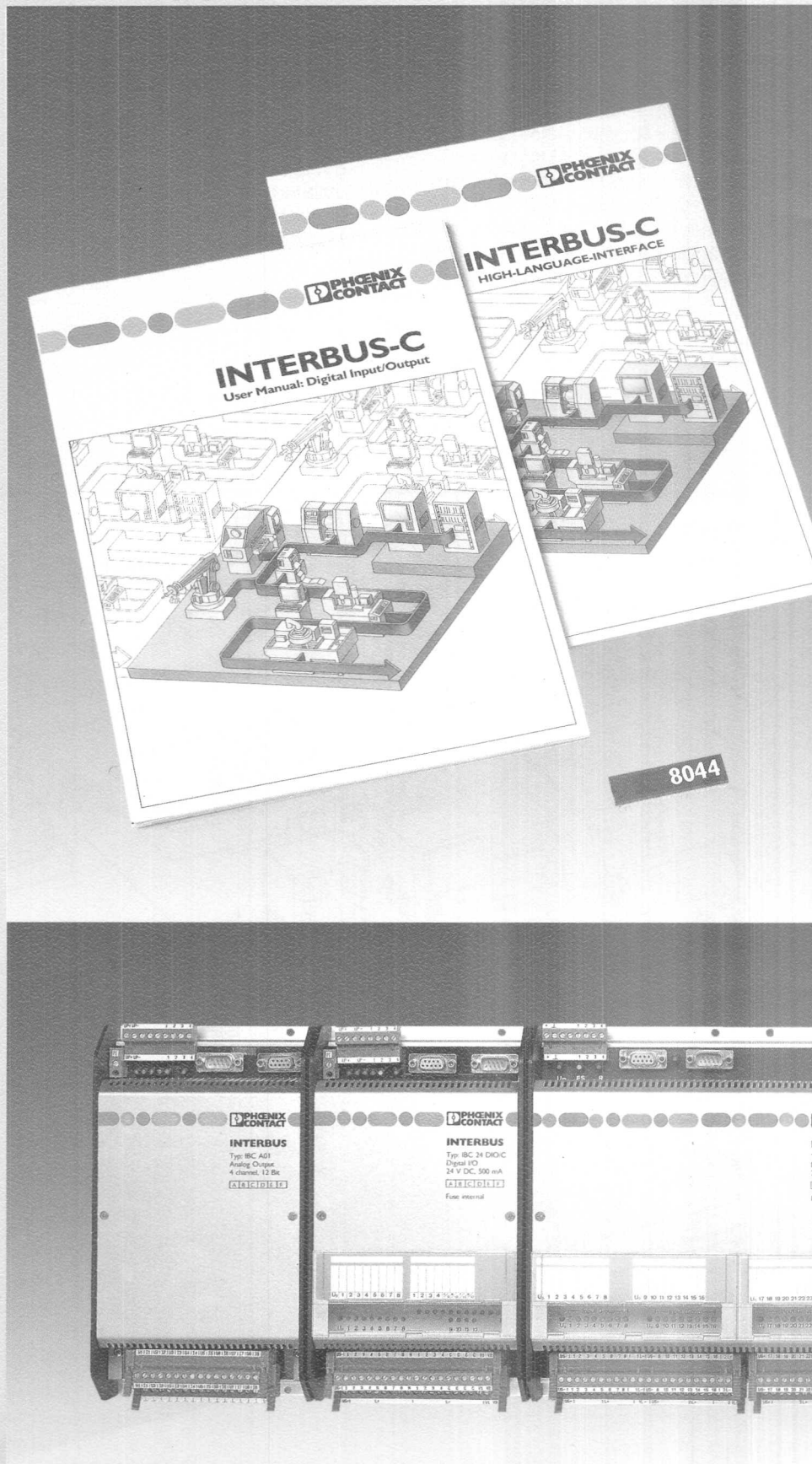
The decisive factor is a broad network support by the most important manufacturers of computer and control systems. Universal and easy network access to the most important host systems also allows for fast spreading and standardization of distributed network architectures.

Today Bitbus networks – and thus INTERBUS-C as well – can be linked to all industrial control systems and process control computers. The Intel Bitbus is thus established as a standardized input/output host system network for I/O signal transmission.

Today the majority of the control and computer system manufacturers comply with the users' demand for open interfaces and device interoperability by supporting Bitbus interfacing both with regard to the hardware and software. This wide acceptance for the Intel Bitbus ensures that already today the INTERBUS-C modules operate with the following computer systems:

- Digital Micro-Vax computers
- IBM industrial process computer systems, PC, XT, AT and compatibles,
- IBM system P 2 (under development),
- Intel system 300 (Multibus),
- Siemens SMP/AMS systems,
- Motorola VMEbus systems.

The INTERBUS-CV.24 master module (IBC V.24 M) allows Bitbus access for all process computers and programmable controllers (PLCs) that yet do not accommodate a direct Bitbus interface.



SYSTEM OVERVIEW

INTERBUS-C-Distributed-I/O-Module Line

The increasing number of Bitbus compatible process computers simultaneously involves the extension of the INTERBUS-C I/O module line.

Currently, already 29 INTERBUS-C I/O modules are available which help realize almost every distributed control versions:

Controller Units

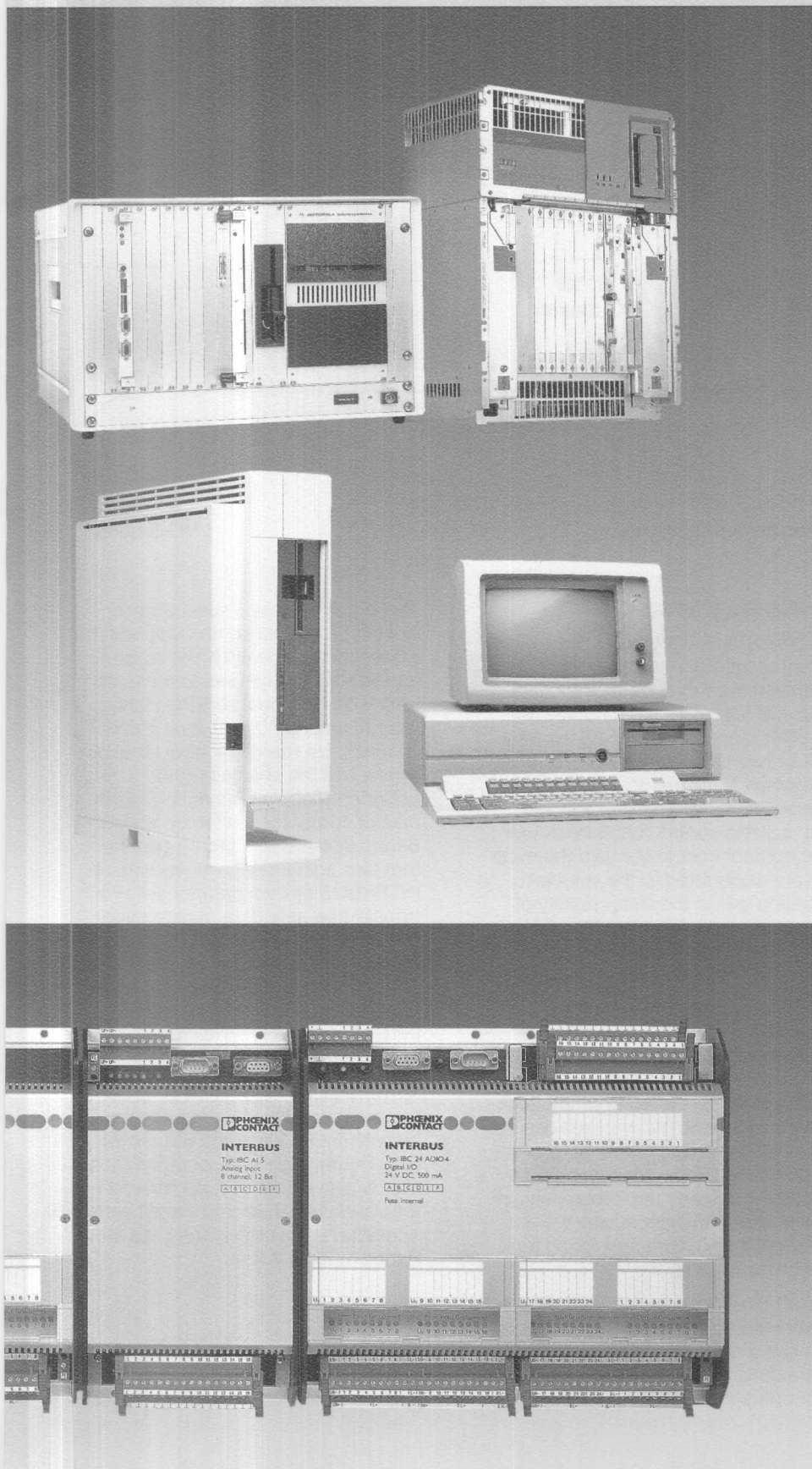
- IBC PC CON Controller board for IBM, IC, PC, XT, AT and compatible computers
- IBC V.24 (RS-232-C) Interface module for computer systems which do not accommodate a Bitbus interface

Digital/Analog I/O Modules

- IBC 24 DIO C 16 digital inputs/outputs
- IBC 24 DIO 32 digital inputs/outputs
- IBC AI 1-5 16 analog inputs
- IBC 24 ADIO 1-5 32 digital inputs/outputs, 16 analog inputs
- IBC AO 1/2 8 analog outputs
- IBC 24 AODIO 1-5 32 digital inputs/outputs, 8 analog outputs
- IBC EU Expander module for digital and analog inputs/outputs
- IBC 24 EDI 1 64 digital inputs for expander
- IBC 24 EDO 1 64 digital outputs for expander
- IBC EDIO 16 digital inputs/outputs for expander
- IBC EAIO 16 analog inputs/outputs for expander

Communication Modules

- IBC V.24 (RS-232-C) With 2 RS-232-C/V.24 interfaces
- IBC BDE 01 Data acquisition terminal
- IBC ETools-VIS 01 Process visualization



SYSTEM ARCHITECTURE

INTERBUS-C Architecture

System Configuration

INTERBUS-C complies with all Intel Bitbus specifications, the latter designed as an open master-slave field bus system.

INTERBUS-C supports all electrical data transmission mechanisms defined for the Bitbus by Intel. A bus master centrally controls slave access to the bus within the centrally controlled Bitbus. This master station manages all data transmission activities. Communication is made according to a determined call-respond mechanism. The master transmits prompts and awaits a response from the addressed slave station within a given period. If the master does not receive a valid response within a previously defined time, the prompt is repeated several times. In the case of unsuccessful repetition the master registers the station as off-line.

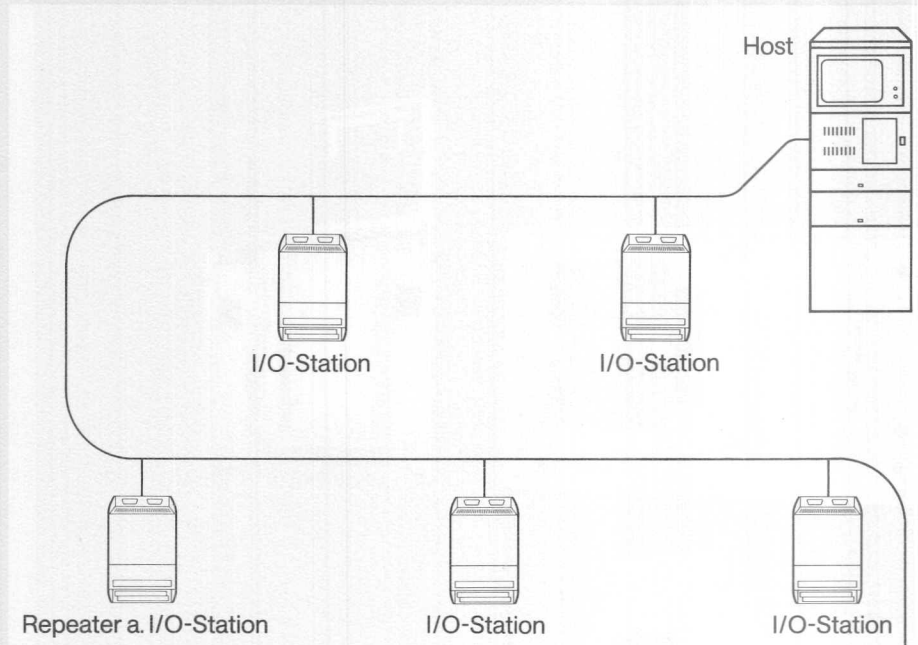
To assure secure operation in a rough industrial environment the INTERBUS-C concept offers features that far exceed the Bitbus system scope specified by Intel.

INTERBUS-C consists of two main elements: Controller board and intelligent I/O modules.

Controller board for IBM PCs

The INTERBUS-C controller board enables the Bitbus to be connected to all IBM PCs and compatibles. Every free PC slot accepts the controller board. The PC becomes the host computer for the network and communicates with the individual slaves via the bus controller.

The controller uses the Intel 8044 microprocessor, a RAM unit for data buffering, an EPROM memory and drivers for the electric Bitbus interface which is in accordance with the RS 485 standard. Further, the controller is electrically isolated from the PC. The efficient controller DCX 51 operating system provides user-oriented programming in all standard high-languages, supported by an appropriate driver software. The controller controls and monitors all network slaves which support the Intel Bitbus specifications.



I/O Modules (Slaves)

The INTERBUS-C I/O modules are designed as intelligent microprocessor-controlled front-end-stations for data input and output. All I/O modules use the 8044 processor including the Intel DCX 51 real-time, multi-tasking operating system. The latter offers high-level programmed user software support, thus realizing control functions at low development cost. In the field the modules are easily fitted to the standard mounting rails in the direct vicinity of the sensors and actuators. The signal lines of the process periphery are directly connected to the modules.

The basic function of the INTERBUS-C I/O modules is a protected I/O communication transfer between controller and process using the Bitbus protocol (RAC-format). By inputting simple parameter instructions the modules can be extended to intelligent data preprocessing sub-stations. Module data preprocessing offloads the Bitbus network and simultaneously increases the bus system efficiency for transmitting real-time process data.

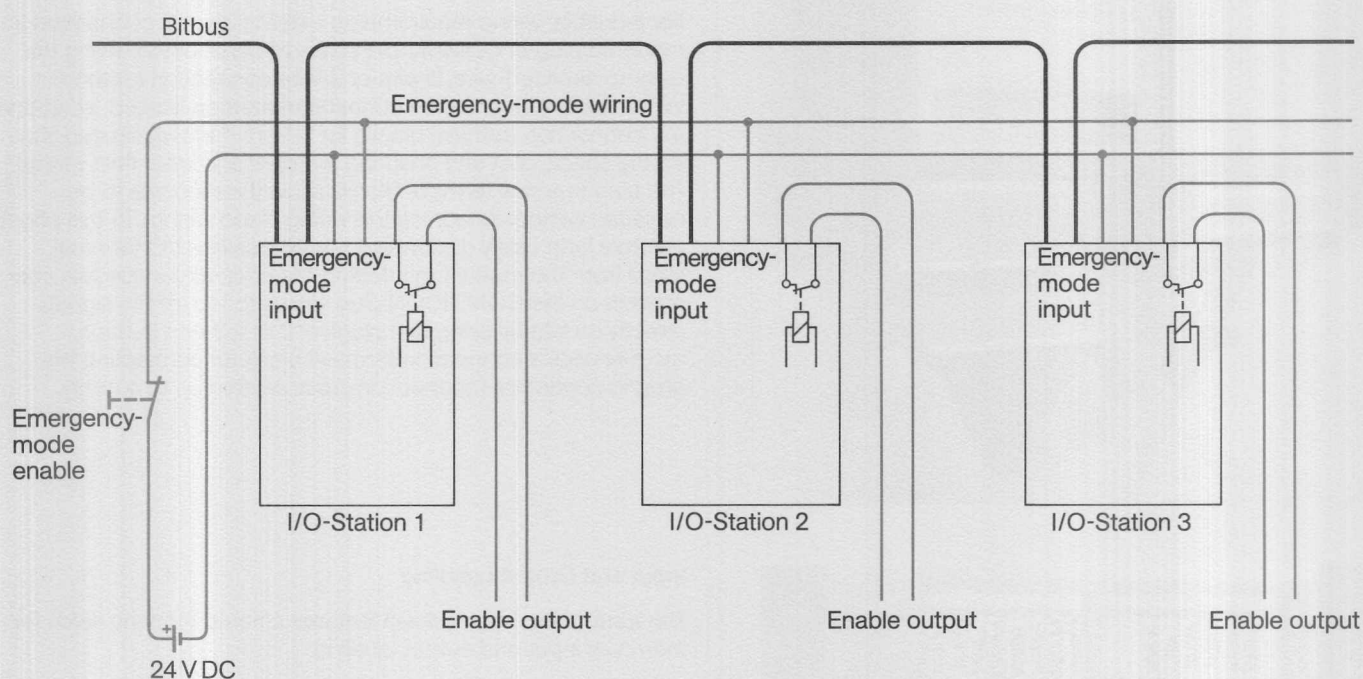
The I/O modules assure safe data preparation and transmission. As industrial data stations they conform to all technical safety requirements of modern plant operation.

This is achieved by a safe galvanic isolation, separate control loop and the emergency-mode alike. The latter function allows the user to manually switch off individual stations in the case of emergency or failure. The I/O channels are then optionally reset or frozen and the enable output activated. Module connection to the master computer is effected via the 6-core Bitbus cable. D-Sub connectors also guarantee here – as with all INTERBUS system components – a trouble-free, safe data transmission. After a certain number of installed slaves or cable lengths, the Intel Bitbus specification requires the installation of a repeater for signal conditioning. All INTERBUS-C I/O modules feature this repeater function as a standard.

To avoid external tap units from the bus every module accommodates an incoming and outgoing Bitbus interface. During standard operation there are no active components between the interfaces. Thus safe overall system operation is ensured in the case of Bitbus module failure.

SYSTEM FEATURES

Emergency-mode Function



Emergency-mode

Hardware and software design for industrial automation places special demand on electronic modules which are used for direct machine control.

Also distributed I/O systems networked to the central control system have to meet the existing regulations and guidelines for the equipping and operating of plants and machines.

One of the most important requirements for safe plant operation: Irrespective of the state of the network, master or central control system it must be possible to manually force "on site" the module function to adopt a defined state.

For this reason, all INTERBUS-C modules are provided with an emergency-mode input that helps set all outputs of a module into a defined state at any time.

Emergency-mode wiring is made via a separate line thus being independent of the host computer or the bus cable. By enabling the emergency-mode input all outputs of the network are simultaneously disabled or switched off.

Additionally, each module features a floating NCC relay output indicating the external emergency-mode prompt, e.g. enabled by operating a switch. The host computer can also centrally enable the emergency-mode via the network.

The separate emergency-mode wiring allows to interconnect individual modules or complete module groups to form a functional unit by implementing an additional safety circuit.

Function

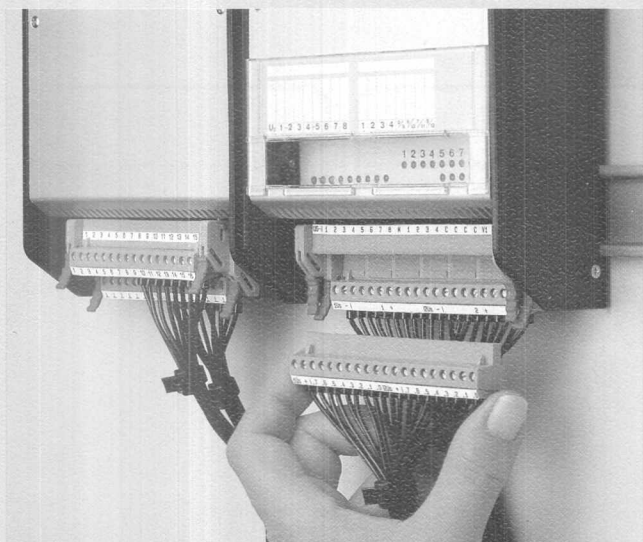
As soon as the emergency-mode input of an INTERBUS-C module is actuated all outputs assume a defined state (reset or freezing). The enable output of the module designed as relay output is activated, allowing emergency-mode prompt reprocessing in external monitoring facilities.

After enabling the emergency-mode all modules remain in the waiting setting until being reactivated by a start command from the master.

The emergency-stop input needs a logic "1". An emergency-stop push-button for manual triggering installed in the process should be an NCC. Thereby, cabling of the safety circuit is monitored simultaneously.

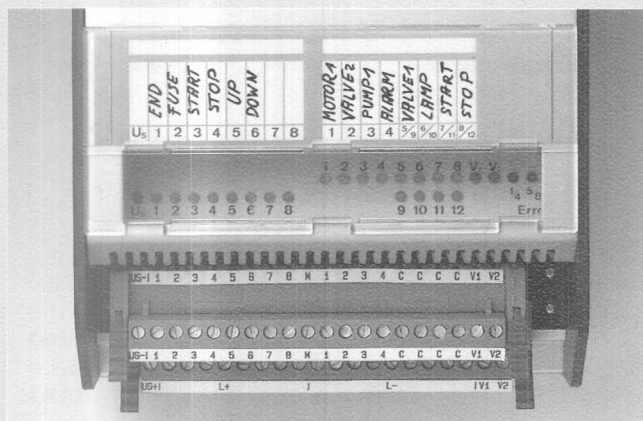
Note: The safety regulations required for machine shutdown in the case of danger (refer to IEC 204/1) are not replaced by the emergency-mode implemented in the INTERBUS-C modules. The emergency-mode can be integrated in the external safety circuits as an important element to realize safe plant operation.

SYSTEM FEATURES



Installation of Signal Lines

For industrial wiring requirements external device connection is made via plug-in COMBICON screw terminal blocks using the easy-to-service 1-wire, 2-wire or 3-wire connection method. When the 2-wire or 3-wire connection method is used additional I/O connection terminal blocks for "+" or "-" are eliminated, thus saving space, cost and ensuring a proper and clear field wiring! The plug-in screw terminal blocks allow the modules to be replaced without loosening the wiring (fixed wiring). To this effect ejectors help easily disconnect the 20-position I/O terminal strips from the module. In addition, the easy-to-service test connection on the COMBICON plug allows to tap off the signals directly on site by using test plugs of 2 or 2.3 mm ϕ . Each module uses a connection terminal block for connecting the ground conductor (connection cross section up to 4 mm²).

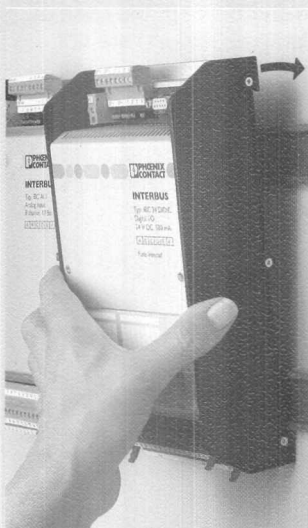


Input and Output Labeling

The front of the I/O modules features colored marking fields for individual input and output labeling.

LED Displays of Inputs and Outputs

LEDs indicate the status of digital inputs/outputs, the operating voltage as well as interferences. For instantaneous error indication on site LEDs additionally indicate short-circuit or fuse defects in an output module.



Module Installation

Rail mounting:

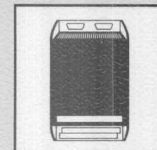
The modules engage to the bottom mounting rail, swing down in the direction of the mounting surface and lock in position on the top mounting rail. The engagement catch at the back of the module guarantees secure fit on the mounting rail.

Direct mounting:

Four mounting holes allow the modules to be directly panel-mounted.

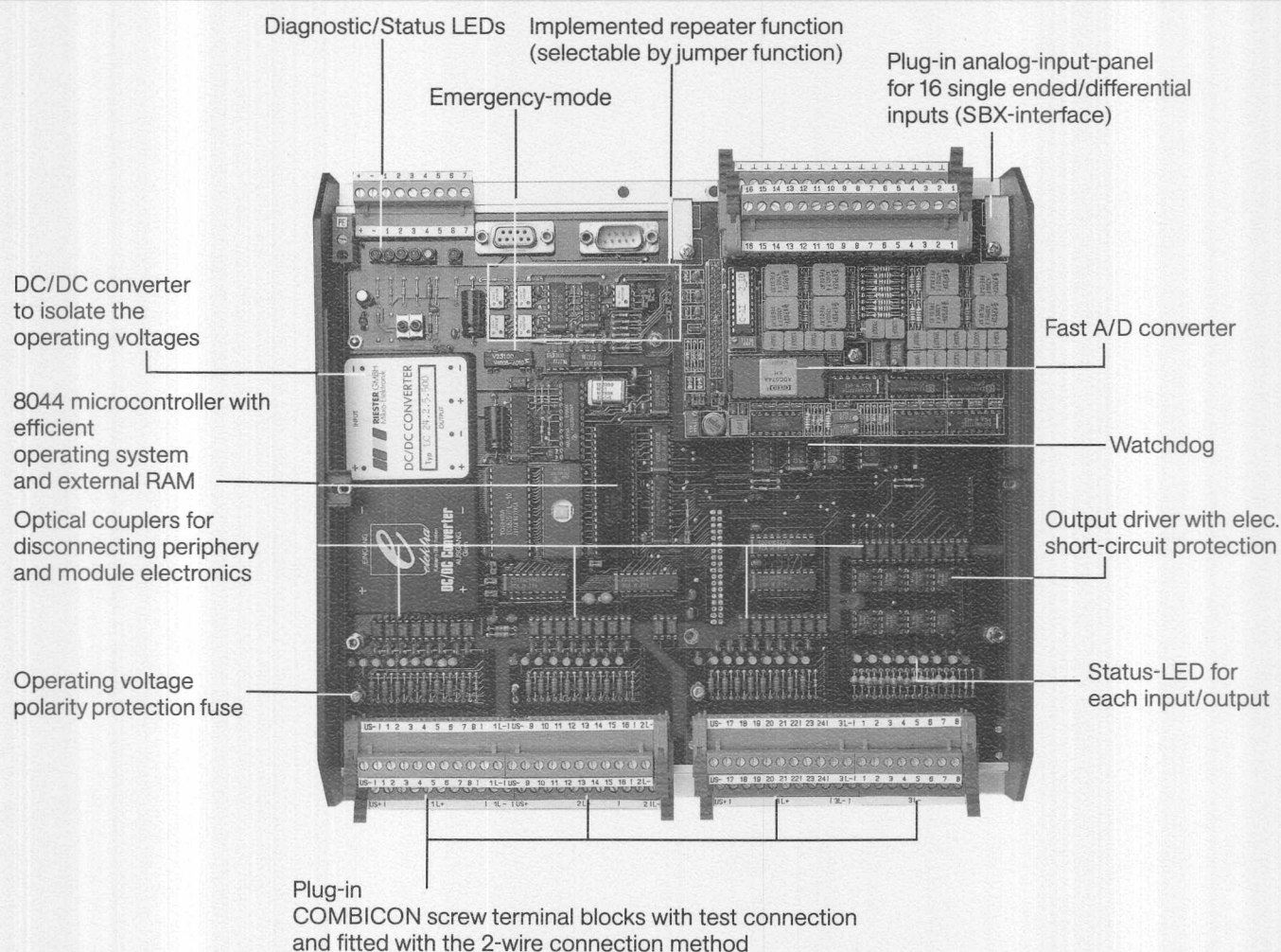
Note

To easily plan the application of INTERBUS the brochure: INTERBUS-C planning tool, Order No. 27 85 96 7 is available on request.



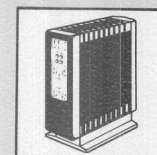
MODULES

Internal Module Configuration



Basic System Specifications

Overall system extension	Max. 13.2 km
Operating mode	Bitbus self-clocked mode
Transmission protocol	SDLC; Intel-Bitbus
Transmission speed	375/62.5 kBit/s
Number of possible repeaters	2/10
Number of modules between 2 repeaters	28
Data security	CR-Check
Galvanic isolation	Yes
Manual safety functions	Emergency-stop line
Bitbus cable	Twisted pair



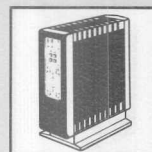
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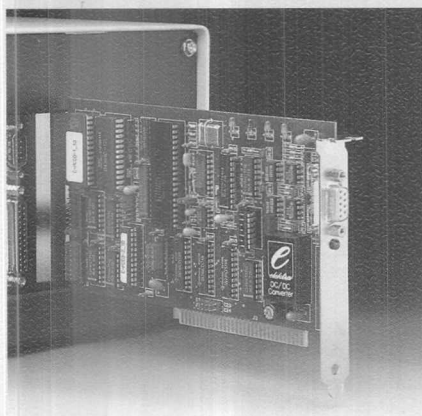
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CONTROLLER UNITS

Controller Board for all IBM-PCs



INTERBUS controller boards for Bitbus connection to all IBM-PCs.

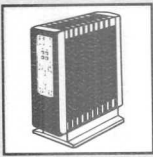
By plugging-in the INTERBUS IBC PC CON controller board every IBM-PC and compatible computers can be connected to the Intel Bitbus. In connection with INTERBUS-C the IBM industrial PC (IC) along with the broad standard range of user software for measuring, controlling, regulating and logging presents new possibilities for the industrial automation. As a standard computer the industrial PC assumes important functions in the industrial CIM-concept. For direct standard Bitbus network connection the intelligent INTERBUS-C controller board can be easily plugged in every free PC slot.

The INTERBUS-C Bitbus board implies all necessary interface standards and does not need to be retrofitted to meet sophisticated requirements of the industrial environment. The controller board is securely isolated from the PC-bus. The IB-C controller board complies with all national and international regulations for multi-user operation. The controller board transforms the personal computer into a host using the real-time Bitbus system. The controller board independently controls and monitors all Bitbus slaves that meet the Intel Bitbus specifications.

Ordering Data

	Type	Order No.
Controller board for IBM computers incl. users manual	IBC PC CON	27 85 08 0
Additional users manual for the IB-C controller board	IBC UPC CON	27 85 63 7
High-language interface incl. users manual for the following software packages ¹⁾		
- Microsoft QUICK BASIC Compiler		
5 1/4" floppy disk	IBC HQBC	27 85 32 3
3 1/2" floppy disk	IBC HQBC 3	27 85 87 3
- Microsoft PASCAL Compiler		
5 1/4" floppy disk	IBC HPC	27 85 33 6
3 1/2" floppy disk	IBC HPC 3	27 85 88 6
- Microsoft C-Compiler		
5 1/4" floppy disk	IBC HCC	27 85 34 9
3 1/2" floppy disk	IBC HCC 3	27 85 89 9
- Microsoft FORTRAN 77 Compiler		
5 1/4" floppy disk	IBC HFC	27 85 35 2
3 1/2" floppy disk	IBC HFC 3	27 85 90 9
- Intel PLM 86		
5 1/4" floppy disk	IBC HPLM	27 85 44 6
3 1/2" floppy disk	IBC HPLM 3	27 85 91 2
- Borland TurboPASCAL		
5 1/4" floppy disk	IBC HTP	27 85 92 5
3 1/2" floppy disk	IBC HTP 3	27 85 93 8
Plug connector for remote bus (packed in pairs)		
- With solder connection	IBC DSUB/L	27 85 19 0
- With crimp snap-in connection	IBC DSUB/C	27 85 20 0

¹⁾ A high-language interface is only available in connection with a controller board. The purchase of the high-language interface includes a Single Software User License (SU).



CONTROLLER UNITS

Controller Board for all IBM-PCs

Every free PC slot accepts the controller board. Address matching as well as transmission speed selection on the bus is made on the controller board via jumpers. The controller board supports the self-clocked Bitbus operating mode.

The figure on the right shows the INTERBUS-C controller board architecture. The board uses the Bitbus 8044 Microcontroller as well as the Intel DCX 51 real-time operating system, safety logic and watchdog functions.

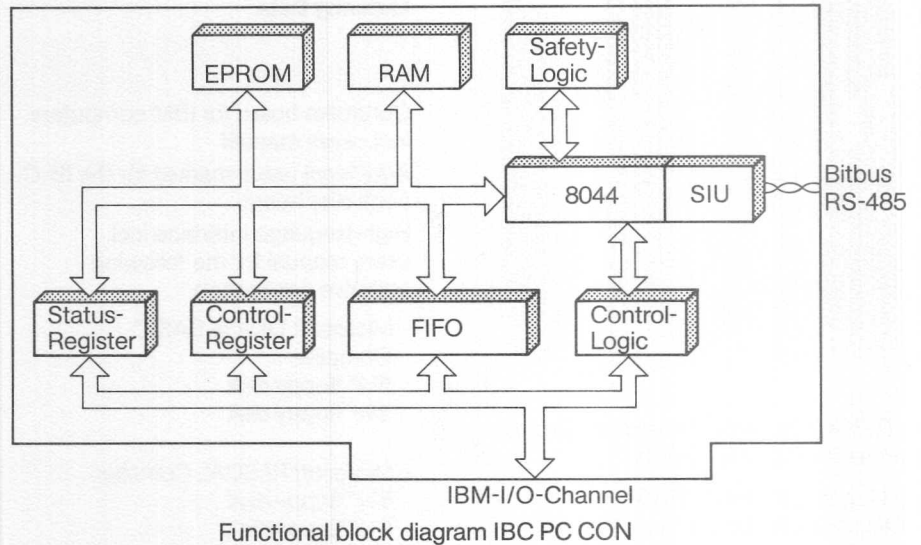
In its RAC task 0 the firmware contains the complete driver software for the individual Bitbus functions such as commands for data input/output, service routines and self-check functions. The autonomous operation mode of the serial interface unit (SIU) allows automatic run of all Bitbus functions which are in accordance with the SDLC protocol, without any burden on the PC! Further, the DCX 51 real-time operating system helps implement a user task on the controller board per download. The automatically running user task thus offloads the host computer and enhances the response-time behavior of the complete network.

Max. 250 stations (Bitbus slaves) may be addressed through the INTERBUS-PC controller board.

Bitbus network programming from all high-languages is possible using a separate high-language interface software.

The INTERBUS-C controller board offers the following functions:

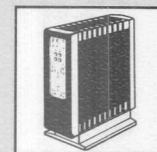
- Diagnostics LEDs for system start-up,
- Galvanic isolation between personal computer and interface board with a test voltage of 2.5 kV.
- Data transmission monitoring by a watchdog-circuit.
- Internal board voltage monitoring setting the processor into a defined state in the case of short-time voltage interruptions.
- Additional protection of the controller voltages through plug-in fuses for personal computer protection.



Technical Specifications

Controller board per IBM PC	6
Number of I/O modules	250
Transmission speed	375/62.5 kBit/s
Current consumption	700 mA typical
Galv. isolation Bitbus/Controller board	Up to 2.5 kV
Address area	Selectable
Space requirement	1 slot

	kBit/s	Distance between repeaters	No. of slaves between repeaters	Max. number of repeaters
Self clocked mode	375	300 m	28	2
	62.5	1200 m	28	10



CONTROLLER UNITS

INTERBUS-C High-Language Software Interface

Network convenience is not only determined by its technical data, but to a high degree by the system network access from a high-language.

INTERBUS-C provides a comprehensive software library of communication software for the IBM PCs and all compatible computer systems that use the MS DOS/PC DOS operating systems.

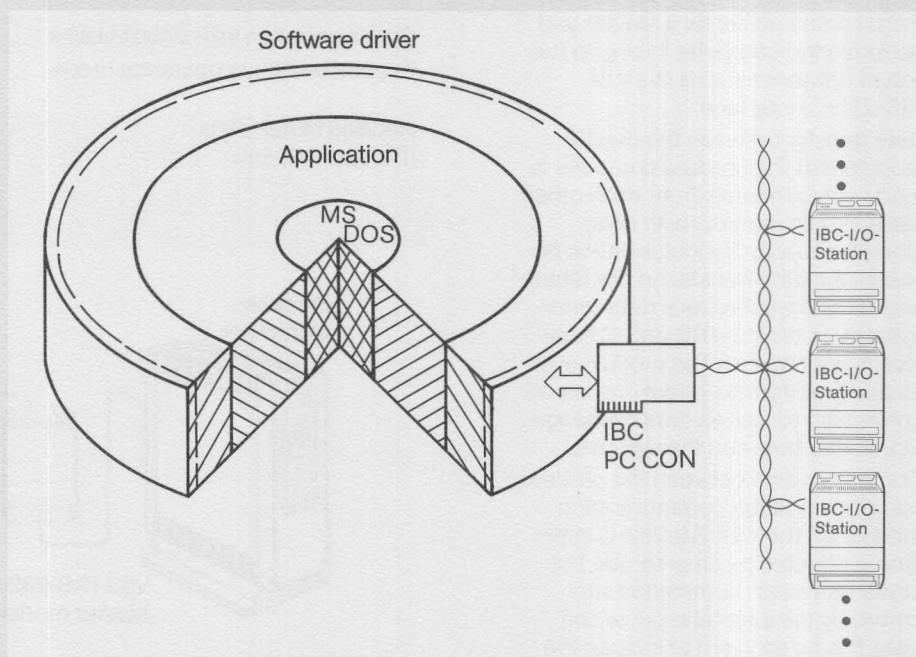
Easy Bitbus network handling from application programs which can be written in every standard programming language is thus possible. Software interfaces are available for the following programming languages:

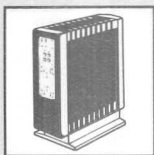
- Microsoft QUICK BASIC Compiler
- Microsoft PASCAL Compiler
- Microsoft C Compiler
- Microsoft FORTRAN
- Intel PLM programs
- Borland TurboPASCAL

All software interfaces are available as linkable object files to be able to completely develop, compile and link user-oriented application programs on the IBM-PC or compatible computers. The high-language software interfaces comprise 22 procedures covering the following main function calls:

- And, Or, Read/Write-Port
- Download of User Tasks
- Create/Delete Tasks
- Read/Write Local Memory
- Send/Receive Message

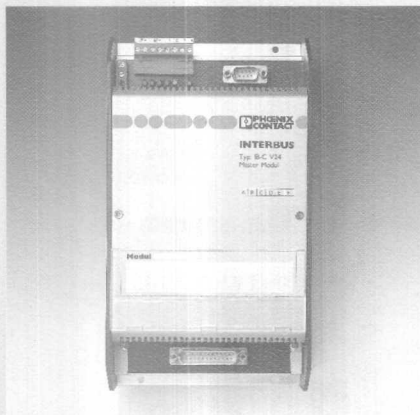
In addition to the user guides, handling of the various software interfaces is documented by a monitor program whose source coding can be utilized by the user. The monitor itself allows every user to realize interactive working with the Bitbus slaves for test and diagnostic purposes.





CONTROLLER UNITS

V.24 (RS-232-C) Master Module



The Intel Bitbus can be connected to all process computer systems featuring a serial asynchronous RS-232-C/V.24 interface via the intelligent master module IBC V.24 M.

As an intelligent communication interface the IBC V.24 master module controls and monitors the data transfer between process computer system and the Bitbus. Supported by the Intel DCX 51 real-time operating system the communication module controls the Bitbus data transfer as a master and performs the computer linking to the actual network host via the V.24 (RS-232-C) interface.

Data transfer between the master module and the process computer is made independently from each other using a main memory with large storage capacity. Synchronisation between fast data transfer on the Bitbus and serial, asynchronous data transmission on the V.24/RS-232-C interface is not required. The module automatically performs system command conversion as well as data exchange monitoring between the systems. Communication between the process computer and the communication module via the V.24/RS-232-C interface is effected by easy-to-use, but powerful system commands supported by the internal module software. It is no problem to include the command structure in all user programs. Additional programming languages or programming knowledge are not required.

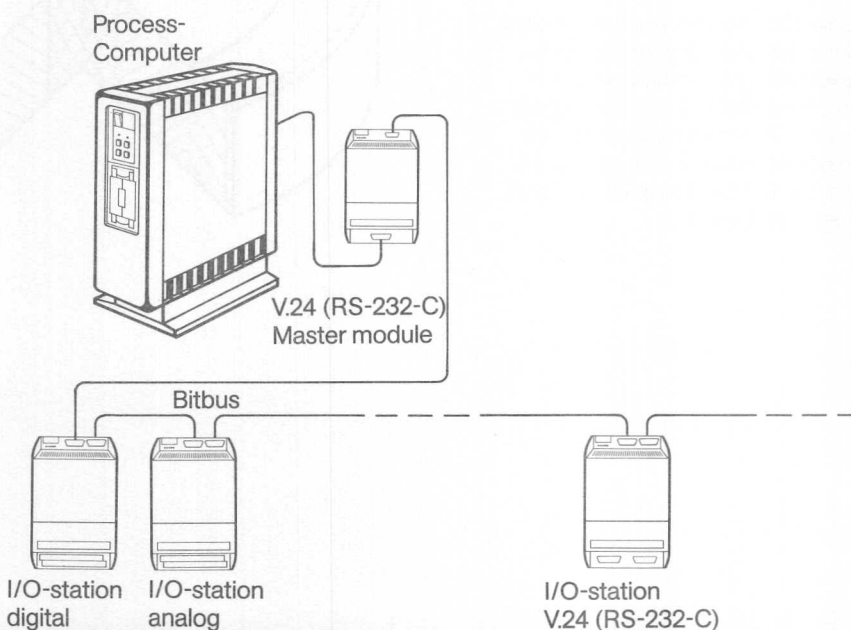
The V.24 (RS-232-C) master module operates as central host station for the Bitbus network, thus allowing a standardized Bitbus network to be also used for all those types of computers for which a separate Bitbus interface is not available.

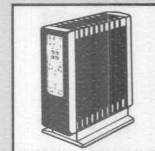
Ordering Data

	Type	Order No.
V.24 (RS-232-C) master module incl. users manual	IBC V.24 M	On request
Additional users manual for the V.24 (RS-232-C) master module	IBC UV.24 M	On request

Technical Specifications

Operating voltage	24 V DC $\pm$ 10%
Interface to the process computer	Standard V.24/RS-232-C
Galvanic isolation Bitbus-V.24(RS-232-C)	2.5 kV
Transmission protocol	Standard ASCII characters
Process computer – IBC V.24 M	Siemens protocol optional
Transmission mode	Full-duplex
Asynchronous operation	
– Number of data bits	5, 6, 7 or 8 data bits programmable
– Number of stop-bits	1 or 2 programmable
	Even, Odd or No Parity programmable
– Transmission speed	110 baud – 19.2 kBaud programmable
– Error detection	Parity error, overflow frame error
Communication with Bitbus slaves	Via ASCII-commands
Supported Bitbus operation mode	Self-clocked mode
	375/62.5 kBit/s
Housing dimensions (D x W x H) in mm	245 x 266 x 66





CONTROLLER UNITS

Bitbus-Controller Board for DEC Micro-VAX Computer Systems

Under the name of DECscan Digital Equipment Corporation offers a combined hardware-software product to embed a Micro-VAX computer system into industrial Bitbus networks.

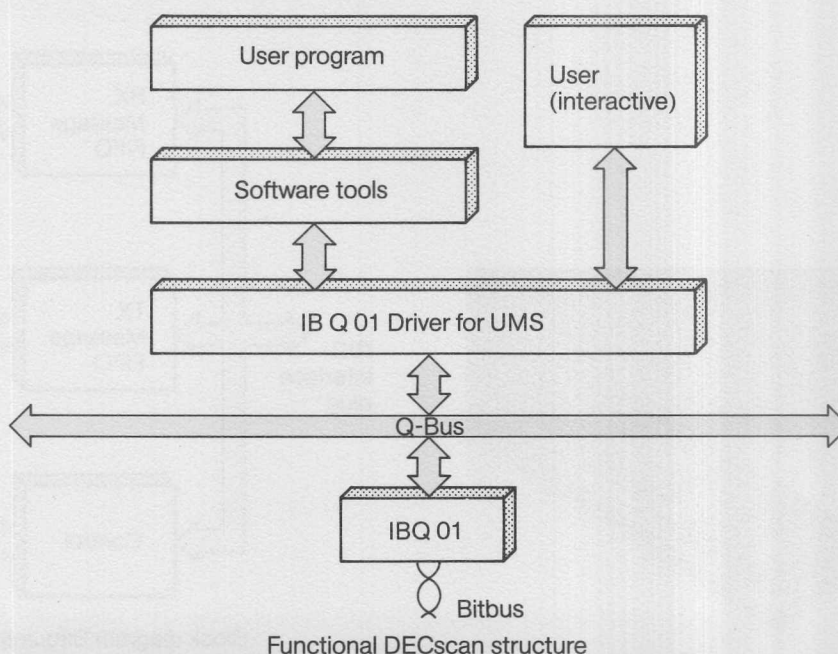
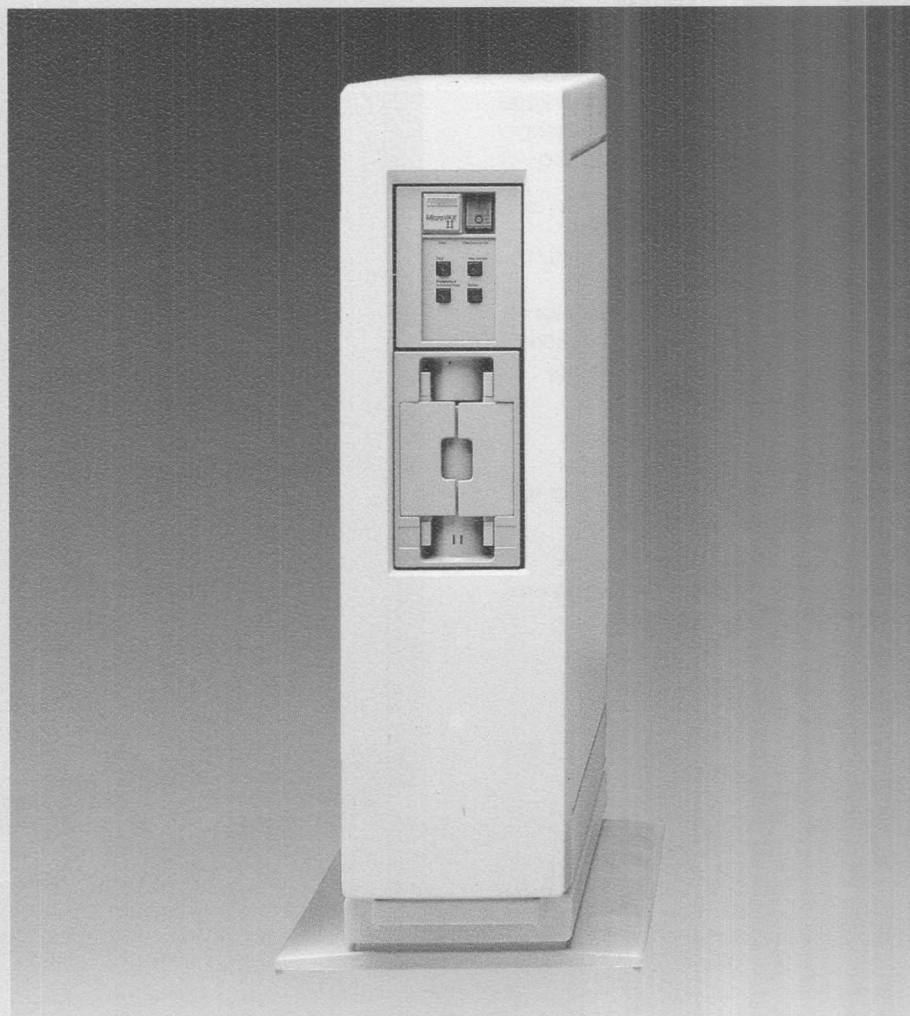
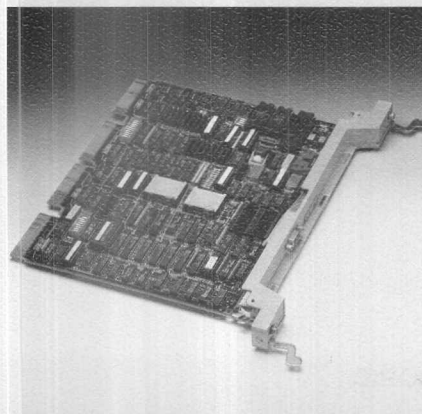
The input/output data in the industrial process are transmitted from and to the industrial VAX-system through the Bitbus network and by using DECscan. DECscan consists of three components:

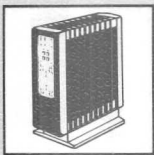
- A controller (IBQ01) representing the hardware interface between Q-bus systems and Bitbus compatible networks. The controller assumes data transmission between the Micro-VAX and Bitbus input/output devices, thus offloading the host computer.
- A software driver (QZZE1), guaranteeing VMS support for the DECscan controller. This software driver uses the standard programming interface for Bitbus function integration into application programs.
- A special set of software tools (QZZE0), simplifying program development for industrial input/output processes. Further to the standardized Intel RAC commands, the DECscan software toolkit supports **all additional Phoenix commands.**

Digital has available the following Bitbus components:

- DECscan I/O toolkit user-support tool
Type: QZZE0
- DECscan/Bitbus controller
Type: IBQ01
- DECscan/VMS-Bitbus-Driver
Type: QZZE1

For further DECscan information please contact your local DEC sales office.





CONTROLLER UNITS

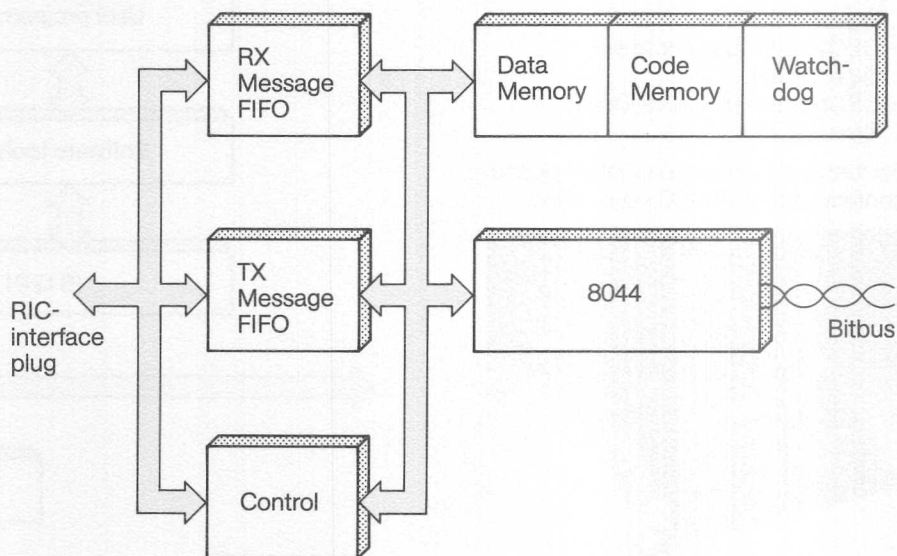
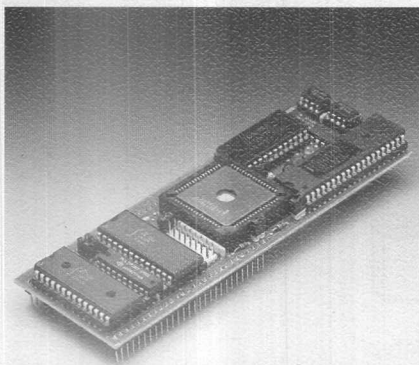
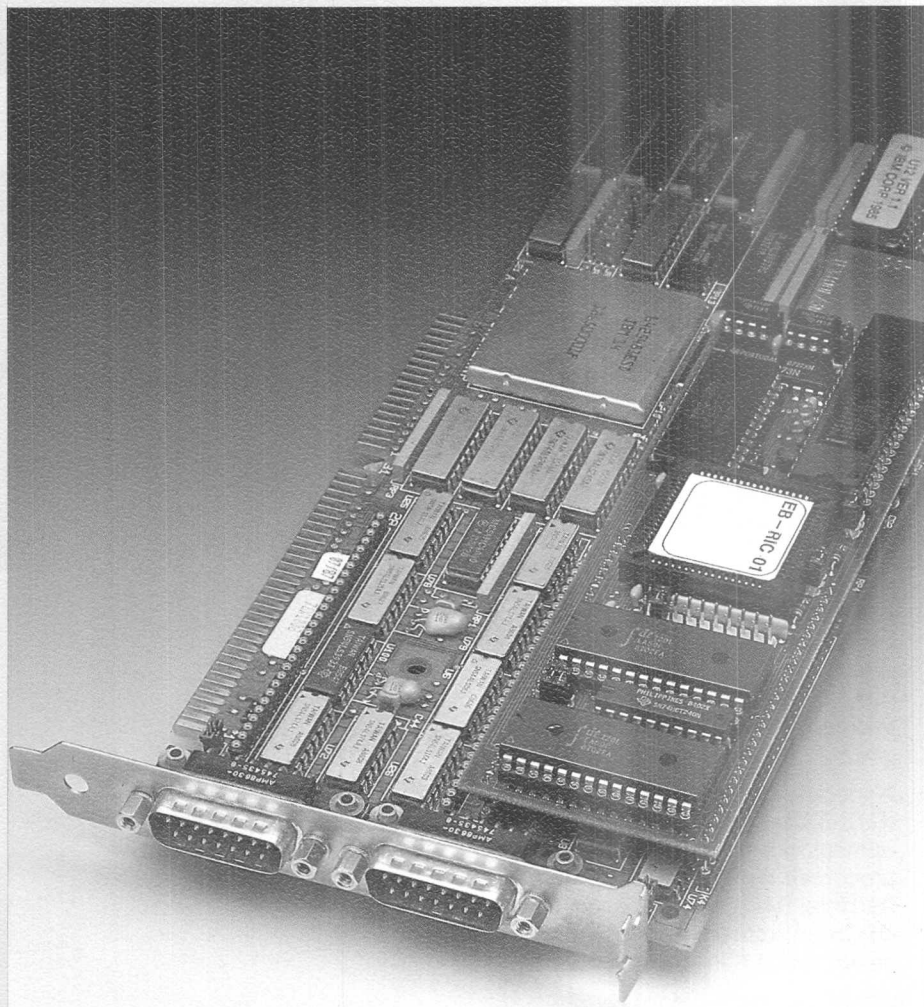
Bitbus Controller Board for the IBM Real-time Interface Co-Processor (RIC)

As plug-in slave board for IBM-RIC processors the IB-C BITBUS-RIC controller board allows to shift bitbus-specific user programs from the industrial or personal computer processor into the Real-time Interface Co-processor.

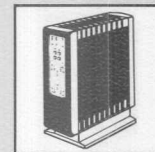
Thus, a high-performance Bitbus controller board for real-time multi-tasking requirements is available which along with the RIC processor allows to perform individual application tasks as well as Bitbus monitoring, thereby offloading the PC.

The Bitbus controller board programming is made using the Intel standard software, host (IBM-AT or IC) access using all standard tools.

Please contact your local Phoenix sales office for further information on the Bitbus IBC-RIC Interface.



Block diagram Bitbus-Interface IBC RIC



CONTROLLER UNITS

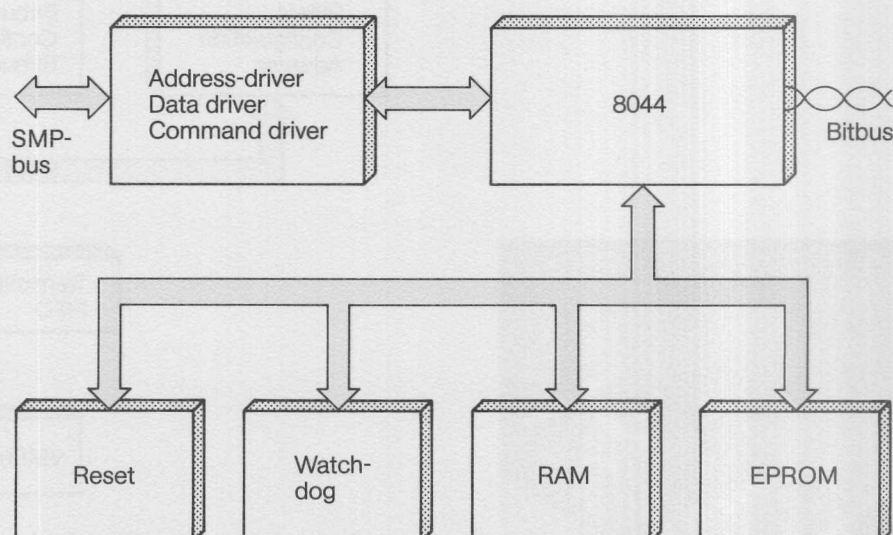
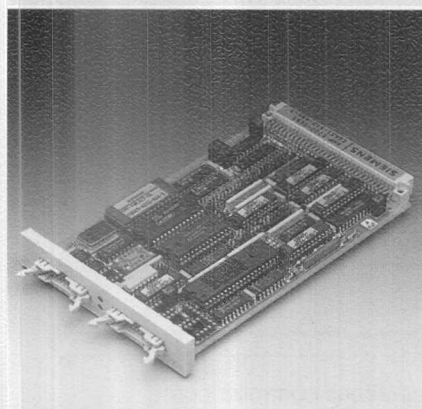
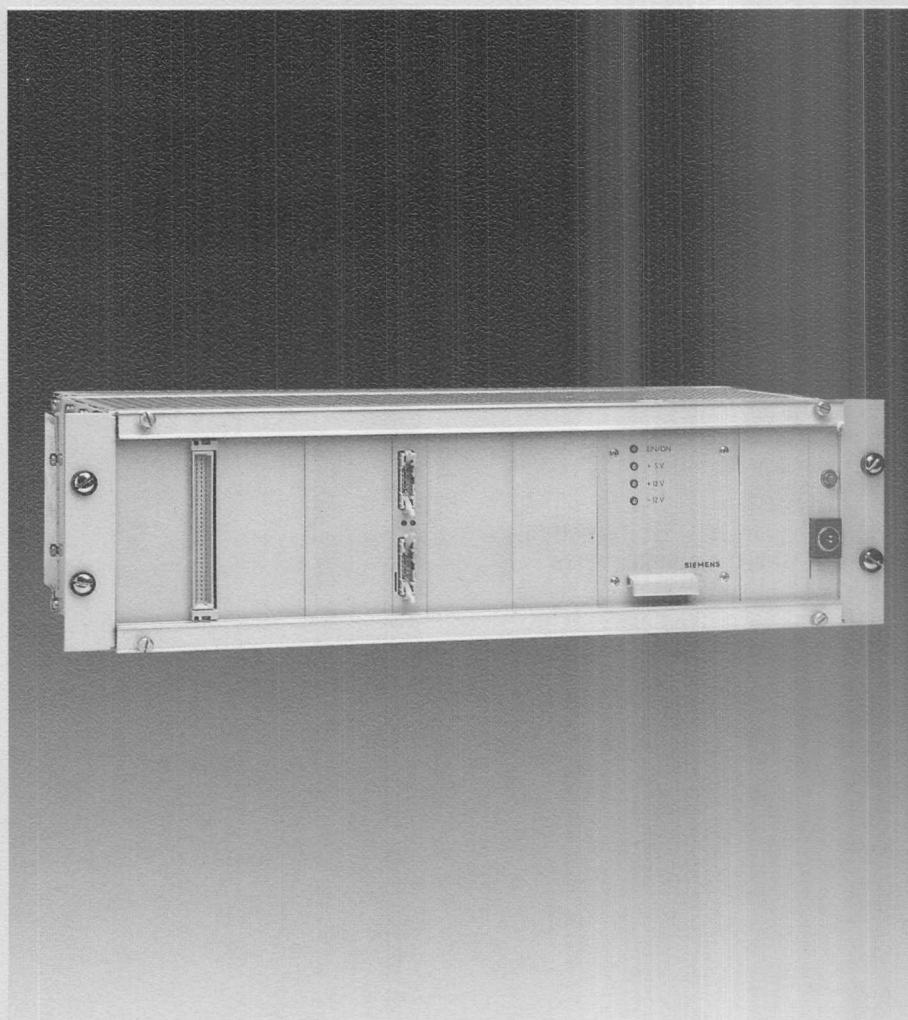
Bitbus Controller Board for Siemens SMP-Systems

The Siemens E227 controller board supports SMP system access to a Bitbus network.

The controller board operates as an intelligent interface connection permitting either SMP system operation as a bus master of a Bitbus network or SMP-system integration as a Bitbus I/O slave.

A card rack may accept the Bitbus E227 controller board along with any interface board of the SMP range.

Please contact your local Siemens sales office for further Siemens Bitbus interface information indicating the type features: SMP-E 227 Bitbus controller board.



Block diagram Bitbus-Controller board SMP-E 227



CONTROLLER UNITS

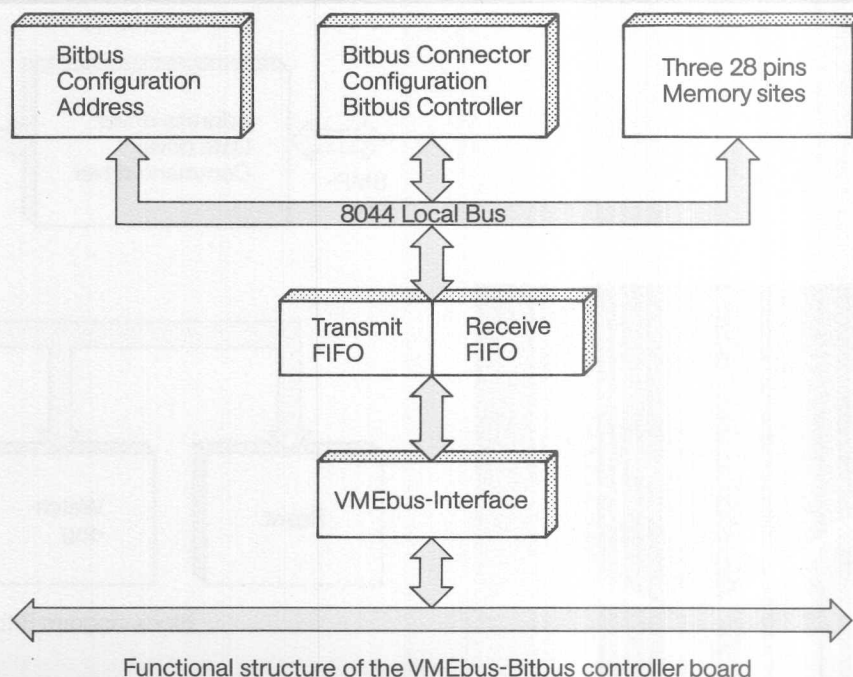
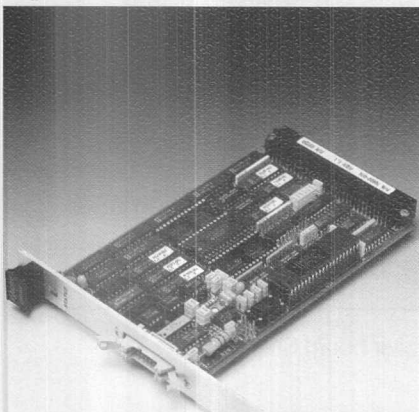
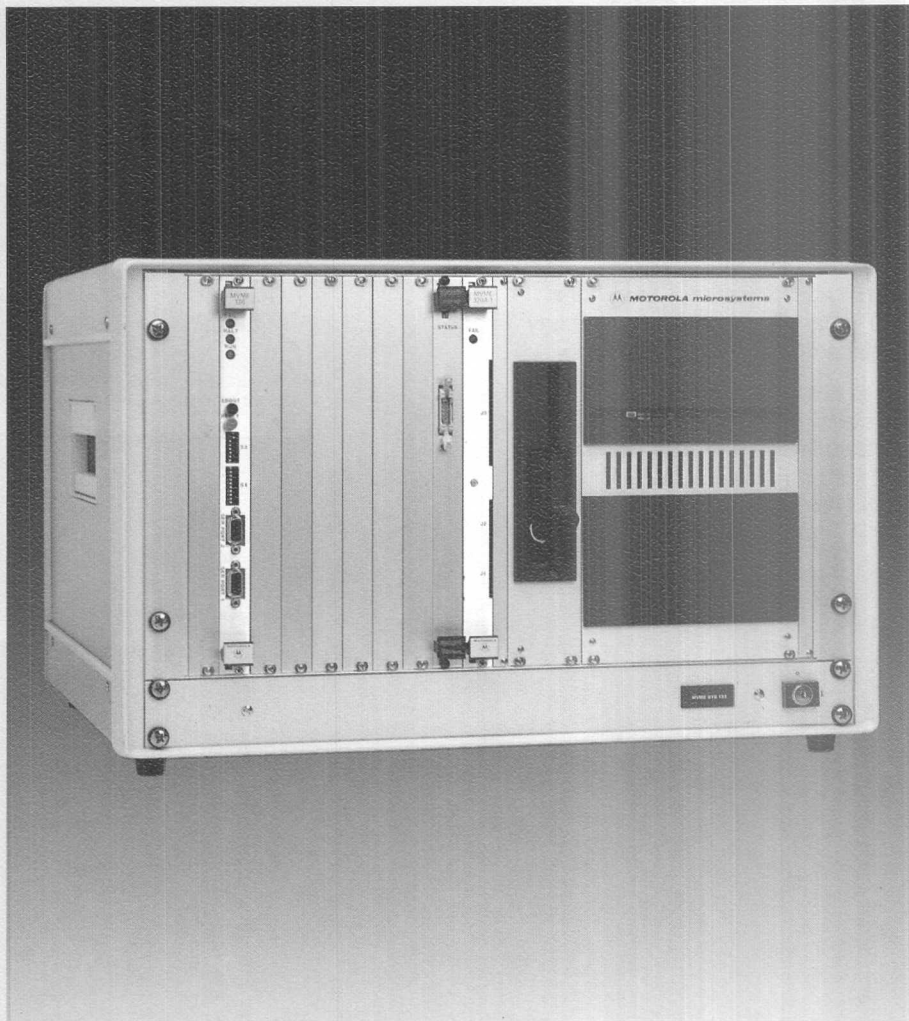
Bitbus Controller for Motorola VMEbus Systems

The XVME-402 Bitbus Controller from the company Xycom Inc. (U.S.) allows for Bitbus network interfacing to all standardized VMEbus systems.

Using the Intel 8044 microcontroller the controller board automatically creates message structures, I/O operations and control functions in accordance with the Bitbus specifications.

VMEbus systems equipped with the Bitbus controller can be used in the Bitbus network both as bus master and I/O slaves. The controller board supports the asynchronous mode of operation. Thereby, the possible transmission speeds are rated for 375 kBit/s or 62.5 kBit/s.

For further information on the VMEbus Bitbus XVME-402 controller board please contact Xycom Inc., 750 North Maple Road, Saline Michigan 48176, U.S., or their local sales offices.





CONTROLLER UNITS

Bitbus Interface for Intel's OEM Computer Families

The Intel Multibus (I and II), and AT-bus interfaces for the Bitbus controller iSBX 344 (iPCX 344) allow industrial Bitbus network access.

For the Bitbus Intel supports the operating systems iRMX (real-time), Xenix and MS-DOS.

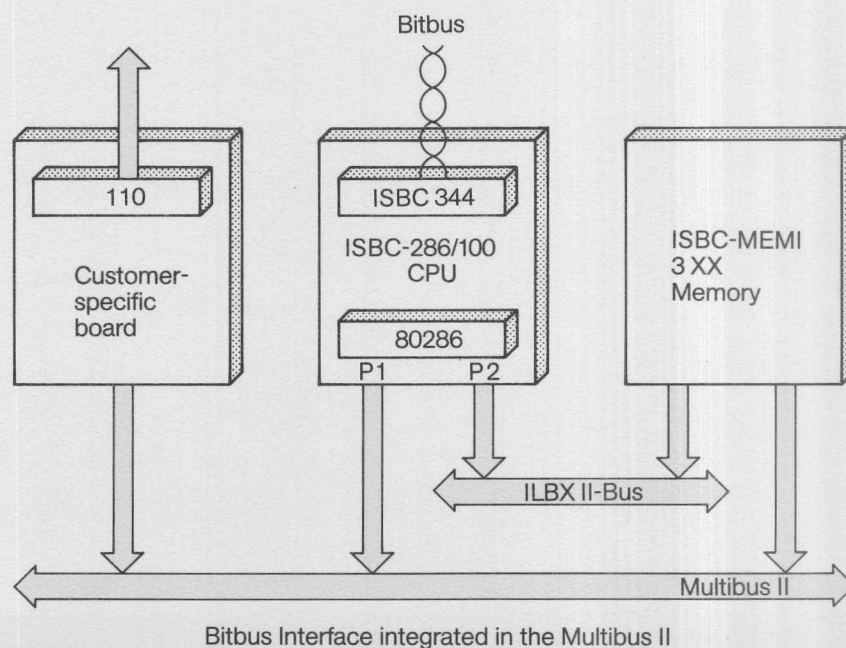
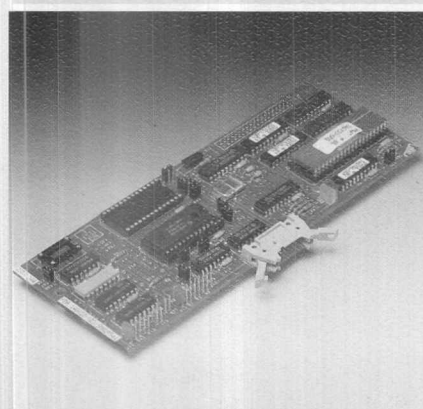
In addition to the hardware Bitbus interface implementation of all standardized Bitbus RAC commands into application programs is supported by a separate driver software package (Bitbus-toolbox).

The latter provides, in addition to a library for application programs, a monitoring function for fast diagnostics in case of faults.

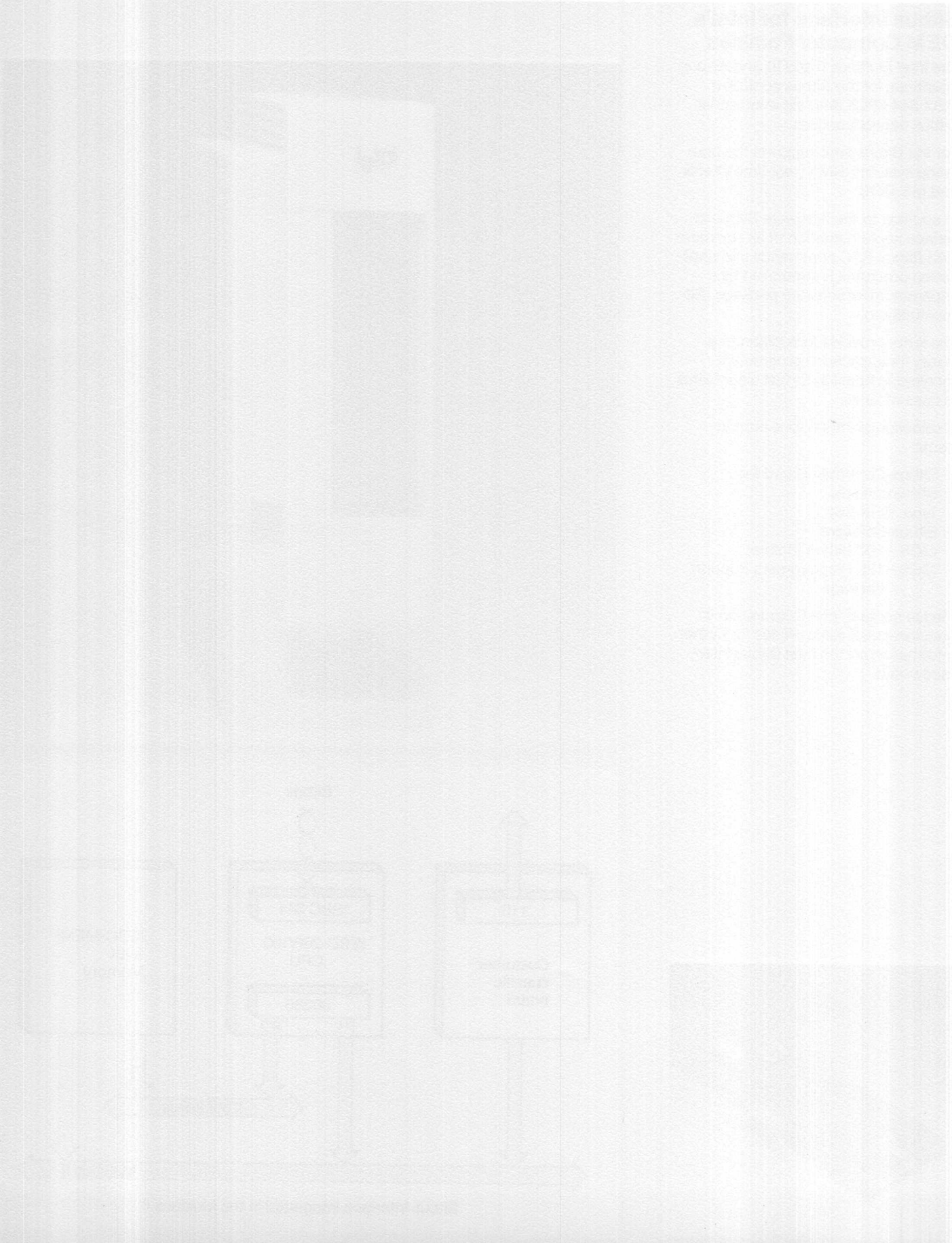
A selection of Intel Bitbus components:

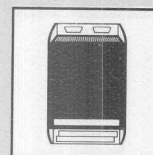
- Bitbus-Controller-Board for SBX-interfaces
Type: iSBX 344
- Bitbus-Software
iDCS - 100 Bitbus Toolbox
iDCS - 120 Programmers Support Package

Please contact Intel Corporation or your local Intel sales offices for further information on the Intel Bitbus interface board.



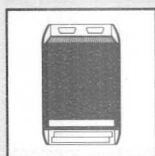
CHAPTER 2





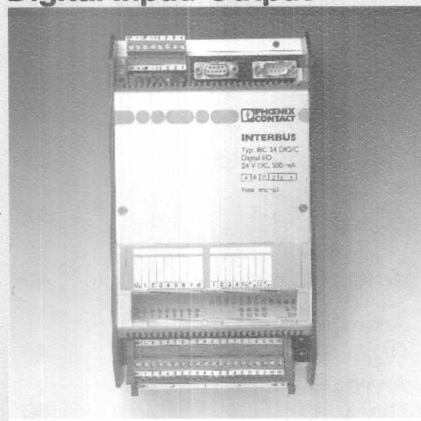
MODULES

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MODULES

Digital Input/Output



The new distributed INTERBUS-C I/O modules can directly be connected to the Intel Bitbus. For realizing local intelligence the compact modules use the 8044 Bitbus processor which also assumes network coupling. The INTERBUS-C I/O modules meet the Intel-Bitbus specifications and operate as intelligent slaves in an open Bitbus network.

Up to 16 binary sensors and actuators can be connected directly to the module via plug-in COMBICON screw terminal blocks. The configuration of the 16 input/output channels is optional:

- 8 inputs, 8 outputs
- 12 inputs, 4 outputs
- 8 inputs, 4 3-wire initiator inputs, 4 outputs

The supply voltage for the module and the operating voltage for the inputs/outputs amount to 24 V DC. The outputs are short-circuit proof and rated for a 500 mA permanent load. All I/O channels are isolated from the module electronics and the Bitbus. The signal lines are connected using the 2-wire, the initiators the 3-wire method. For individual input and output labeling the module features a large marking field. Light emitting diodes indicate the input/output signal state.

Availability as well as overload and short-circuit of the outputs are also LED-indicated. Jumpers help code the required transmission speed (62.5 kBit/s or 375 kBit/s) in the individual modules.

Ordering Data

	Type	Order No.
Digital input/output	IBC 24 DIO/C	27 85 02 2
Configurable, 24 V DC incl. users manual		
Additional users manual for IBC 24 DIO/C	IBC U DIO/C	27 85 64 0

Technical Specifications

Operating voltage U_S	24 V DC
Permissible range*)	20–30 V DC
Supply voltage U_P	24 V DC $\pm$ 10%
Current consumption: module electronics	380 mA

Inputs

Number of inputs	8/12
Number of configurable inputs	4
Galvanic isolation	
- Bus/Periphery	2.5 kV
- Inputs	Yes
Input voltage	
- Rated value	24 V DC
- Permissible range "0" signal	-3 to +5 V
- Permissible range "1" signal	13–30 V
Input current per channel	13 mA
Delay time	0–255 ms

Inputs: Initiators

Number of initiator inputs	4 (3-wire)
Galvanic isolation	
- Bus/Periphery	2.5 kV
- Inputs	In groups of 4
Output voltage for initiators	24 V DC
Max. output voltage	500 mA
Short-circuit protection	Electronic

Outputs

Number of outputs	4/8
Number of configurable outputs	4
Galvanic isolation	
- Bus/Periphery	2.5 kV
- Outputs	Yes
Output voltage	24 V DC
Output current	
- Rated value	500 mA
- Parallel operation	500 mA
Limitation of voltage induced on circuit interruption	Acc. to VDI 3422
Total load capacity per module	
- at 20° C	4 A
- at 55° C	See derating curve
Short-circuit protection	Electronic
Polarity protection of operating voltage U_S	Fuse 5 A
Output signal level at rated current	$U_S - 1.7 V$

Diagnostics

- Operating voltage indicator	LED green
- Status indicator per input	LED yellow
- Output voltage indicator of initiators	LED green
- Short-circuit/overload indicator of initiators	LED red
- Status indicator of outputs	LED yellow
- Short-circuit/overload indicator of outputs	LED red

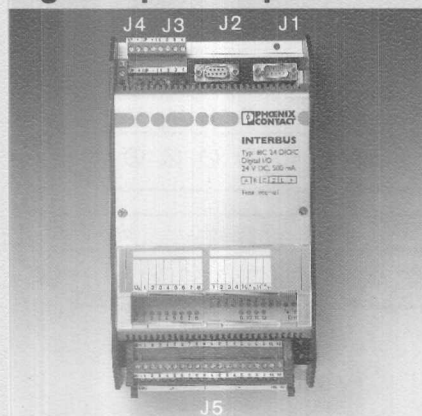
Housing dimensions (DxWxH) in mm	245x129x66
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*) Including ripple



MODULES

Digital Input/Output



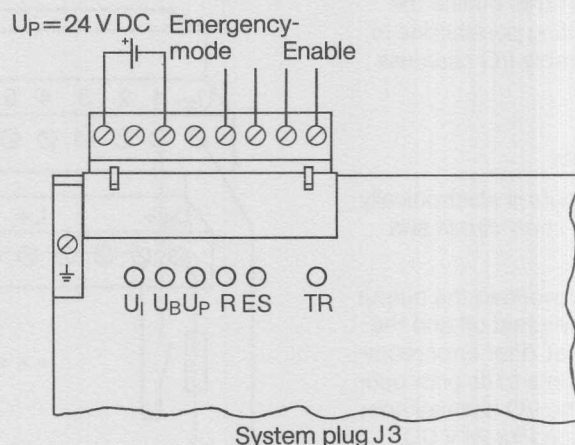
- J1 Output Bitbus
- J2 Input Bitbus
- J3 System plug
- J4 Grounding wire connection
- J5 Input/Output group

A sophisticated isolation assures secure I/O module operation in industrial environment. The external supply voltage is electrically isolated both from the module electronics and the Bitbus network through a DC/DC converter with two isolated outputs. The galvanic isolation with a test voltage of 2.5 kV complies with all VDE- and IEC-requirements for safe multi-user system operation.

Additional monitoring functions such as watchdog-timer and emergency-mode increase I/O module reliability.

The functional scope of the IBC module can be extended by the following functions which are supported by the INTERBUS module firmware.

- Reading of the module identification
- Defining 2 inputs as counter
- Defining an output as single-shot
- Defining an output as clock generator
- Inverting the input/output data
- Programmable time delay at all inputs
- Programmable off delay at all outputs



The Bitbus cable is connected to the I/O modules (J1 and J2) via the 9 position D-Sub plug connection with shielded housing recommended by Intel.

The signal lines of the sensors and actuators and the supply voltage are connected in an easy-to-service manner via COMBICON plug-in screw terminal blocks (J 5) with a connection cross section of 2.5 mm². Terminal assignment of the inputs/outputs is itemized on the following pages.

Wiring of the emergency-mode, the enable output and the external voltage supply is achieved using the system plug (J 3).

Colored diagnostic LEDs indicate the correctly applied operating voltage, inform on the emergency-mode input status and signal the transmit mode via a special transmit-LED.

Wires up to 4 mm² can be connected to the ground terminal block (J 4).

- U_I – Internal supply voltage for microcontrollers
- U_B – Bitbus supply voltage
- U_P – Module supply voltage
- R – Reset
LED on: Supply voltage correct
LED off: Module reset
- ES – Emergency-stop
LED on: Operating state
LED off: Module in emergency-stop
- TR – Transmit
LED on: Module transmits a message



MODULES

Digital Input/Output

The following examples outline the signal line connecting possibilities to the freely configurable I/O channels

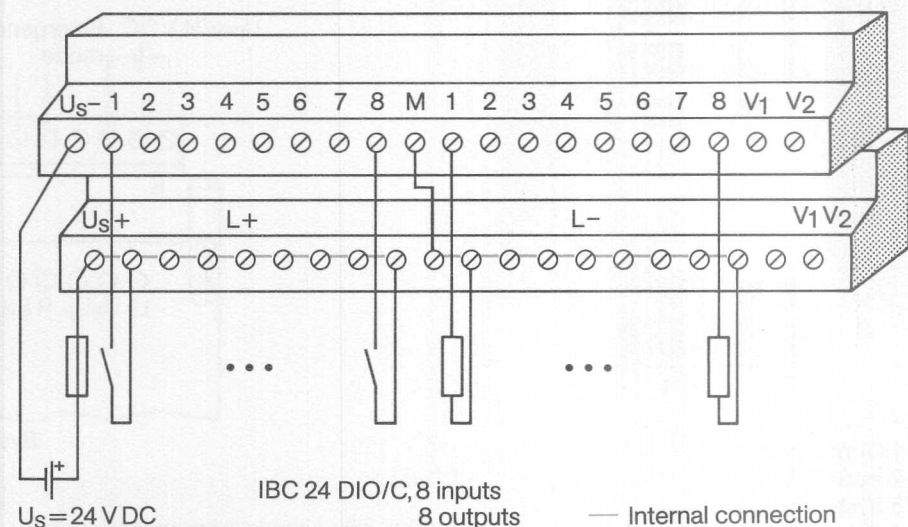
Example 1:

8 Inputs/8 Outputs

Each of the 8 outputs is electronically protected against short-circuit and thermal overload.

In the event of an overload the output is automatically switched off and the LED "ERROR" is set. After error recovery the output returns to its prior operating condition. The I/O channel operating voltage is rated for 24 V DC.

Terminal assignment as well as the input/output interface are illustrated in the following diagrams.



Example 2:

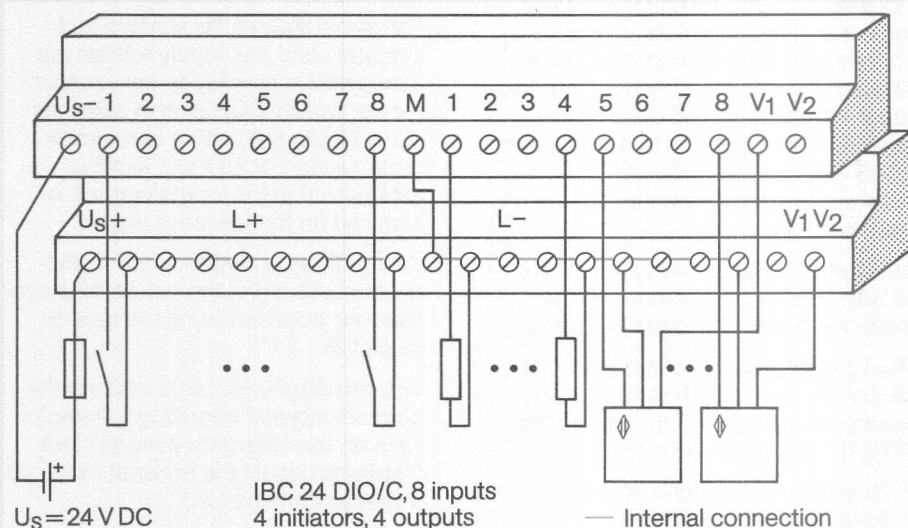
8 Inputs, 4 3-Wire Initiators and 4 Outputs

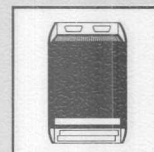
This I/O configuration allows 8 binary sensors, 4 3-wire approximate initiators and 4 actuators to be connected simultaneously. The initiators are 3-wire connected whilst the standard I/O signals are 2-wire connected.

The voltage supply (24 V DC, 500 mA) of the 3-wire initiators is effected directly from the module via short-circuit proof semiconductor outputs without intermediate wiring.

Colored LEDs signal the applied supply voltage and a possible short-circuit on the initiators.

The connection of 8 inputs and 4 outputs is as described in example 1.





MODULES

Command List IBC 24 DIO/C

Intel-RAC-Commands

Reset Slave

Get Function I/D

RAC Protect/Unprotect

Read I/O

Write I/O

Update I/O

OR I/O

AND I/O

XOR I/O

Status Read

Status Write

Node Info

Additional Phoenix Commands

Counter Definition

- Allows to specify 2 inputs that can be freely defined as counters
(max. counting value 65.536, counting frequency up to 250 Hz)

Single-Shot-Definition

- One output may be assigned the single-shot function

Clock Definition

- One output may be specified as clock generator

Input/Output Definition

- Allows to invert the input/output data of all inputs/outputs

Debounce Time

- All inputs may be assigned variable debouncing times

Trigger-Single-Shot

- Command enabling a rectangular pulse for an output previously defined

Read-Counter

- Allows to read in the defined counters (optional with restart function)

Off-Delay Outputs

- Freely programmable off-delay for 4 outputs

On-Delay Outputs

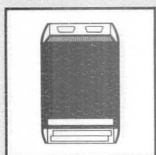
- Freely programmable on-delay for 4 outputs

In addition to a high electrical dependability and reliable mechanics the INTERBUS-C modules stands out particularly due to a user-related scope of functions.

The firmware of the IBC 24 DIO/C processes all Intel-RAC-commands referred to on the left.

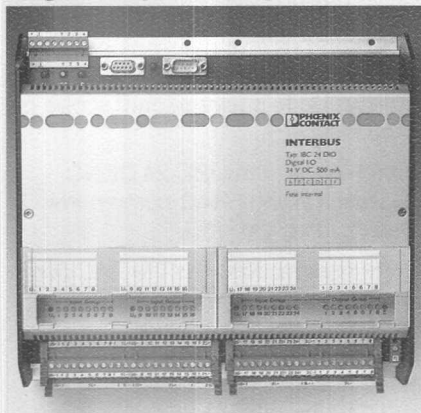
As the present scope of the RAC commands does not fully take advantage of the modules' efficiency and intelligence, the Phoenix commands listed on the left have been additionally integrated to the module firmware. The command list extension eases operation, especially for industrial users. All extensions are implemented so as to match the standard Intel concept. The extension commands are operated with the existing Bitbus software and may be used by different master systems.

For detailed description of the Phoenix commands please refer to the chapter "programming", beginning from page 76.



MODULES

Digital Input/Output



Flexible controlling, instead of expensive wiring.

- Up to 32 sensors and actuators may be connected to the intelligent INTERBUS-C-I/O module. The compact I/O module offers a wide technical and economical leeway whenever many I/O signals have to be processed.

The intelligent I/O module can be connected directly to the Intel Bitbus. The INTERBUS I/O modules conform to the Intel-Bitbus specifications and operate as intelligent slaves in the open Bitbus network. Up to **24 inputs** and **8 outputs** are directly 2-wire connected. 3-wire initiators can be directly connected to 12 inputs without marshalling distributors for “+” or “–” voltages. The compact module minimizes wiring demands. External intermediate terminal points are superfluous. Documentation and service are simplified.

External module supply voltage and the input/output operating voltage amount to 24 V DC. The short-circuit proof outputs are designed for a 500 mA permanent load. All I/O channels are isolated from the module electronics and the Bitbus. LEDs indicate the signal status of the individual inputs/outputs. For individual I/O labeling the module features a large marking field.

The ready status as well as overload and short-circuit of the outputs are also displayed via LEDs. Convenient LED diagnostics “on site” facilitates start-up and service.

Ordering Data

	Type	Order No.
Digital input/output 24 V DC incl. users manual	IBC 24 DIO	27 85 01 9
Additional users manual for IBC 24 DIO	IBC UDIO	27 85 65 3

Technical Specifications

Operating voltage U_S	24 V DC
Permissible range*)	20–30 V DC
Supply voltage U_P	24 V DC $\pm$ 10%
Current consumption: Module electronics	Max. 500 mA

Inputs

Number of inputs	24
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 8
Input voltage	
– Rated value	24 V DC
– Permissible range for “0” signal	–30 V to +5 V
– Permissible range for “1” signal	13–30 V
Input current per channel	7 mA
Delay time	
– Input groups 1 and 2	3 ms typical
– Input group 3	0–255 ms

Inputs: Initiators

Number of initiator-inputs	12 (3-wire)
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 4
Output voltage for initiators	24 V DC
Short-circuit protection	Fuse 1 A

Outputs

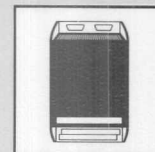
Number of outputs	8
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Outputs	Yes
Output voltage	24 V DC
Output current	
– Rated value	500 mA
Limitation of voltage induced on circuit interruption	Acc. to VDI 3422
Total load capacity per module	
– at 20° C	4 A
– at 55° C	See derating curve
Short-circuit protection	Electronic
Polarity protection of operating voltage	Fuse 5 A
Signal level of outputs at rated value	$U_S - 1.5 V$

Diagnostics

– Operating voltage indicator per group	LED green
– Status indicator per input	LED yellow
– Status indicator per output	LED yellow
– Short-circuit/overload indicator of outputs	LED red

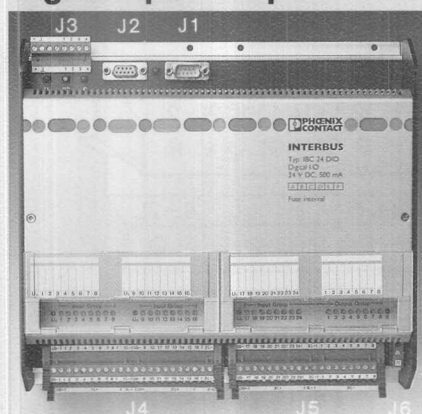
Housing dimensions (D x W x H) in mm	245 x 266 x 66
--------------------------------------	----------------

*) including ripple

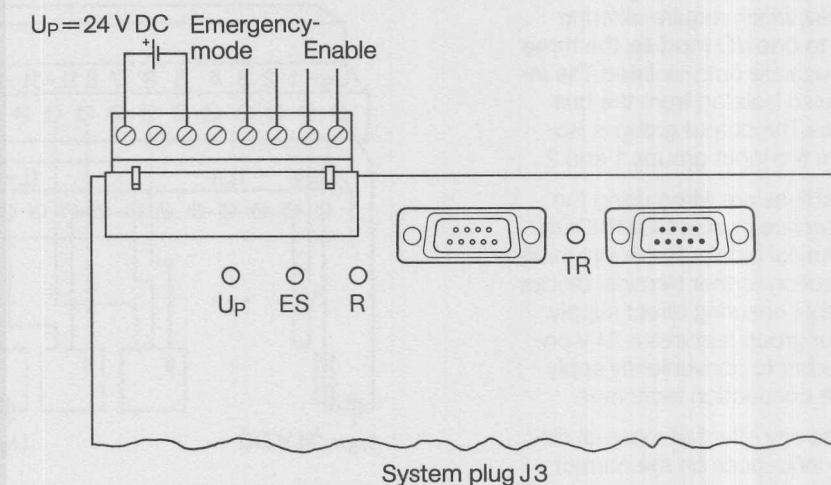


MODULES

Digital Input/Output



- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Input groups 1 and 2
- J 5 Input group 3
- J 6 Output group
- J 6 Grounding wire connection



- Up – Module supply voltage
- ES – Emergency-stop
 - LED on: Operating state
 - LED off: Module in emergency-stop
- R – Reset
 - LED on: Supply voltage correct
 - LED off: Module reset
- TR – Transmit
 - LED on: Module transmits a message

Secure I/O module operation in industrial environment is ensured by a sophisticated galvanic isolation. The external supply voltage is electrically isolated from both the module electronics and the Bitbus network via DC/DC converters with two isolated outputs. The galvanic isolation with a test voltage of 2.5 kV conforms to all VDE and IEC regulations required for safe multi-user system operation.

Additional monitoring functions such as watchdog timer and emergency-mode increase dependability. The Intel DCX 51 has been implemented as operating system on the 8044 processor, thus supporting all Intel RAC commands. Furthermore, commands have been specified that considerably extend the module's application capabilities. These supplementary functions are also fully supported by the RAC protocol.

Additional functions:

- Defining 4 inputs as counters.
- Defining 4 outputs as single-shot.
- Defining 4 outputs as clock generator.
- Defining on- and off-delays for all outputs.
- Programmable time delay at all inputs.
- Inverting the input/output data.

The Bitbus cable connects to the I/O modules (J 1 and J 2) via the 9 position D-sub plug connector with shielded housing recommended by Intel.

The signal lines of sensors and actuators are wired via the easy-to-service COMBICON plug-in screw terminal blocks (J 4–J 7). The terminal assignment of the inputs and outputs is illustrated on the following pages.

Wiring of the emergency-stop, the enable output and the external supply voltage is made through the system plug (J 3).

Colored diagnostic LEDs indicate:

- operating voltage active
- status emergency-stop
- transmit

An external grounding wire of up to 4 mm² cross section can be connected via a separate terminal block.

Jumpers help code the transmission rate required (62.5 kBit/s or 375 kBit/s) in the individual INTERBUS-C modules.



MODULES

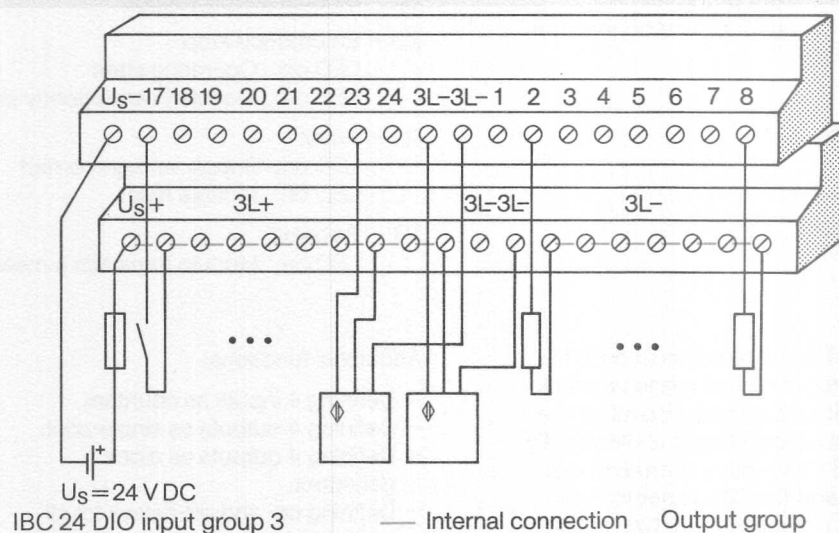
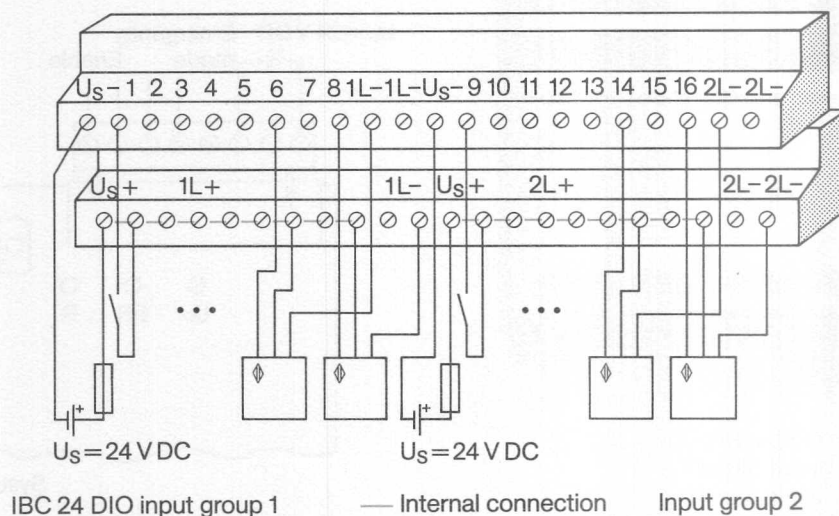
Digital Input/Output

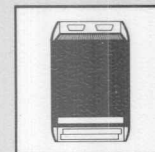
In order to permit the wiring of external devices, which require differing voltages, to one I/O module, the three input groups are opto-isolated. The inputs are also isolated from the bus electronics. The output group is isolated from the input groups 1 and 2.

The signal lines are wired using the easy-to-service plug-in COMBICON screw terminal blocks. For 3-wire initiator connection further terminal blocks are available ensuring direct supply. Each input group features a 24 V potential busbar to conveniently apply the 2-wire connection technique.

To exclude any effect of external disturbance influences on the correct read-in of the instantaneous input information, the input group is software-debounced in the modules. The debouncing time can be freely defined by the user in the range from 0–255 ms governed by special instructions. Detailed commands for module programming are listed on page 77.

By the use of integrated power output stages, the 8 short-circuit protected outputs supply a 500 mA current. A thermal overload protection unit switches off the faulty output in the event of excessive load. Having eliminated the fault, the output channel automatically switches itself on again.





MODULES

Command List IBC 24 DIO

Additional Phoenix Commands

Clock Definition

- Allows to specify up to 4 outputs as clock generator ($f_{\max.} = 50 \text{ Hz}$)

Single Shot Definition

- 4 outputs may be assigned the single-shot function

Retriggerable Single Shot

- 4 outputs may be assigned the retriggerable single-shot function

Input/Output Definition

- Allows to invert input/output data in all inputs/outputs

Debounce Time

- All inputs may be assigned variable debouncing times

Switch Definition

- Allows to activate all inputs as dynamic switches

On-Delay/Off-Delay

- All outputs may be assigned flexible on-/off-delays

Counter Definition

- Allows to specify up to 4 inputs as counters (max. count value 65535; counting frequency up to 25 Hz)

Read Counter with Set

- Sets a counter to a fixed value at simultaneously reading out the instantaneous count

Read Counter

- Allows to read out a counter

Emergency-mode Processing

- Allows emergency-mode processing (release/enable)

The IBC 24 DIO module uses the 8044 microcontroller and an external memory area.

The module firmware includes the Intel DCX 51 real-time operating system. The use of the DCX 51 is the basis for implementing user programs on the module. The additional tasks do not only offload the master computer but simultaneously enhance the response time behavior for time critical applications.

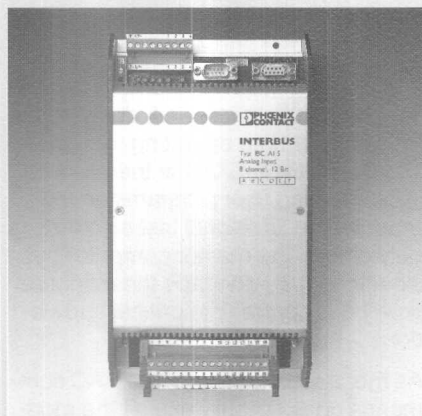
As the present scope of the RAC commands does not fully exploit the module's efficiency and intelligence, the Phoenix commands listed on the left have been included in the module firmware. The command list extension eases operation, particularly for industrial users. All extensions are implemented, so as to match the standard Intel concept. The extension commands are operated by the existing Bitbus software and can be used by various master systems.

For detailed description of the Phoenix commands please refer to the chapter "Programming" beginning from page 76.



MODULES

Analog Input



In the field instruments process measuring quantities (pressure, temperature, flow rate) usually are analog values. The INTERBUS-C analog input modules gather and process the standardized analog signals fail-safe on site. The input modules can be connected directly to the Intel Bitbus. The 8044 processor residing on the module controls measured value acquisition as well as data pre-processing and assumes network coupling.

The INTERBUS-C modules complying with the Intel Bitbus specifications operate as intelligent slaves in an open Bitbus network.

The input module operates independent of the host computer with its own control logic. The analog signals can be connected to the INTERBUS-C module as

- 16 single-ended
- 8 differential
- 8 current signals

The modules for standardized voltage signals use a programmable gain, whereby analog signals from 100 mV to 10 V can directly be connected and processed.

The current inputs are rated for signals from 0 to 20 mA.

A/D conversion is made in the module in 25 μ s conversion time per channel. The acquired measured value digitalized in 12 bits is deposited in the module's memory and can be prompted by the host at any time. The very short internal cycle time also allows to acquire and trace very fast analog signals.

Ordering Data

	Type	Order No.
Analog input		
0-10 V differential	IBC AI 1	27 85 10 3
$\pm$ 10 V differential	IBC AI 2	27 85 15 8
0-10 V single ended	IBC AI 3	27 85 16 1
$\pm$ 10 V single ended	IBC AI 4	27 85 17 4
0-20 mA	IBC AI 5	27 85 18 7
incl. users manual		
Additional users manual for IBC AI	IBC UAI	27 85 66 6

Technical Specifications

Analog Inputs

Programmable input ranges

Gain 1

Gain 10

Gain 100

Number of inputs

Galvanic isolation

- Bus/Periphery

- Operating voltage/Inputs

Input resistance

Connection method of sensors

Measuring value representation 0-10 V
 $\pm$ 10 V

Measuring principle

Conversion time

Permissible voltage between inputs and housing

Noise suppression

Linearity

Basic error limits

- Gain 1

- Gain 10

- Gain 100

Supply voltage U_p

Current consumption

Housing dimensions (DxWxH) in mm

IBC AI 2/AI 4

IBC AI 1/AI 3

IBC AI 5

$\pm$ 10 V

$\pm$ 1 V

$\pm$ 100 mV

0-10 V

0- 1 V

0-100 mV

0-20 mA

8 differential or 16 single-ended

2.5 kV

Yes

1 MOhm

50 Ohm

2-wire connection

12 bit, binary

12 bit, offset-binary

Free-running conversion with successive approximation

25 μ s

$\pm$ 35 V (powered)

$\pm$ 20 V (unpowered)

75 dB min

$\pm$ 1/2 LSB

$\pm$ 0.2 ‰

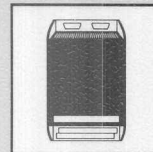
$\pm$ 1.25‰

$\pm$ 1.6 ‰

24 V DC $\pm$ 10%

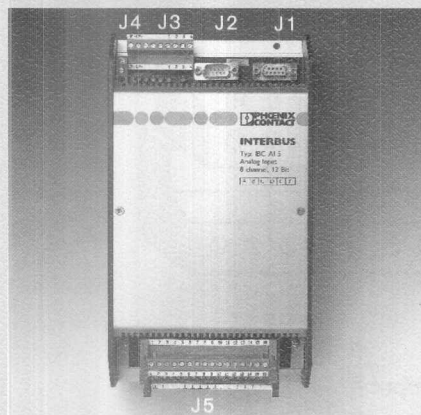
700 mA

245x129x66



MODULES

Analog Input



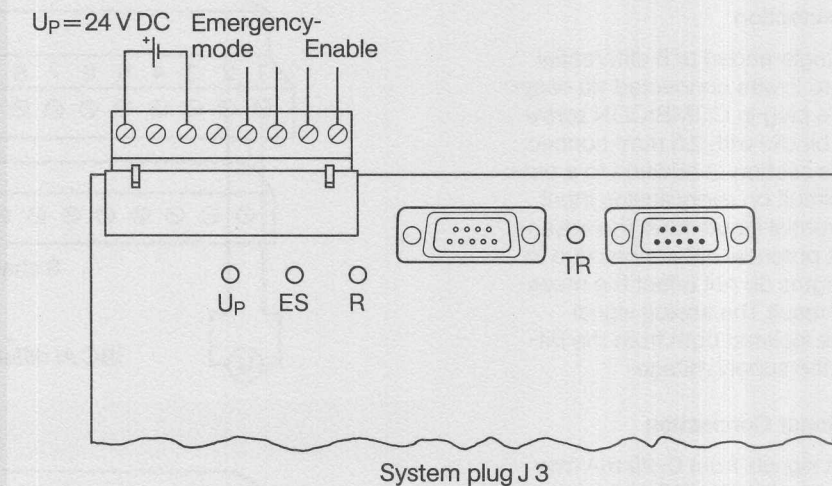
- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Grounding wire connection
- J 5 Input group

In order to exclude external interference signals from the beginning, which could provoke analog signal distortion, all analog inputs are isolated from the Bitbus as well as from the external supply voltage.

Analog signal line connection is effected via the easy-to-service plug-in COMBICON screw terminal blocks (J 4). Terminal assignment for the analog signal lines is documented in detail on the following pages.

The following functions are supported by the module integrated firmware:

- Reading the module identification
- Independent gain programming for each channel
- Reading an analog channel
- Reading an analog channel and the programmed gain



The Bitbus connector should be a 9 position D-Sub plug connector (J 1 and J 2).

Analog signal connection (as differential or single-ended) is made fail-safe through plug-in COMBICON screw terminal blocks (J 4). Terminal assignment for the analog signal lines is documented in detail on the following pages.

The supply voltage of the module as well as the emergency-stop and enabling output are wired on the system plug (J 3).

Colored diagnostic LEDs prove that the operating voltage is correctly applied, indicate the emergency-mode input status and signal the transmit mode via a special Transmit-LED. An external grounding wire up to 4 mm² conductor cross section can be connected using a separate terminal block.

- U_P - Module supply voltage
- ES - Emergency-stop
 - LED on: Operating state
 - LED off: Module in emergency-stop
- R - Reset
 - LED on: Supply voltage correct
 - LED off: Module reset
- TR - Transmit
 - LED on: Module transmits a message



MODULES

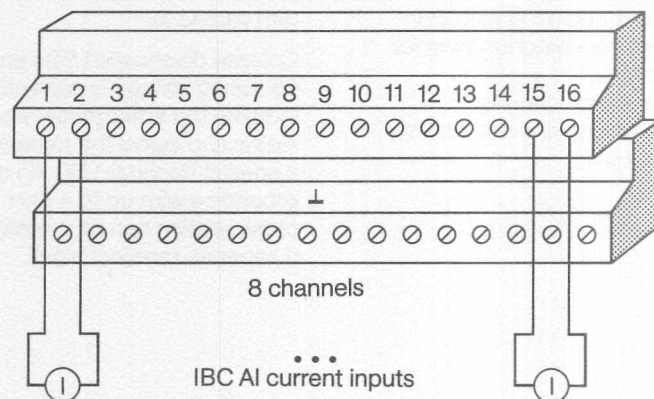
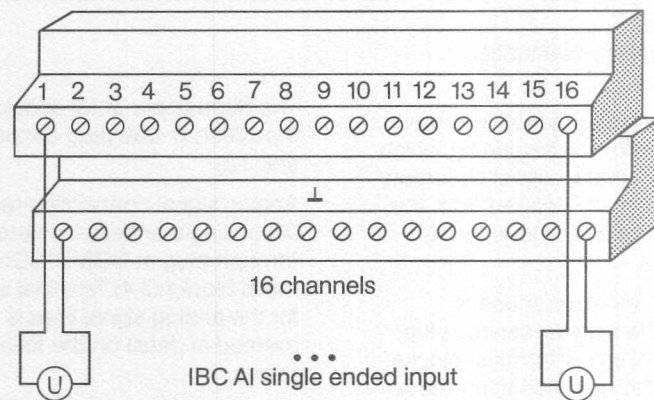
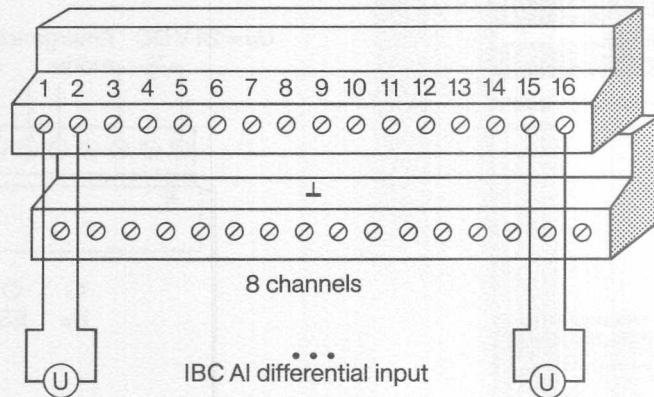
Analog Input

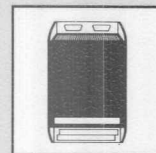
Single-ended/Differential Input Connection

The 16 single-ended or 8 differential signals are 2-wire connected via easy-to-service plug-in COMBICON screw terminal blocks with 2.5 mm² connection cross section. In addition to a protection circuit on every analog input the differential inputs have the advantage that potential differences due to cable lengths do not affect the measurement result. The analog signal inputs are isolated both from the Bitbus and the supply voltage.

Current Input Connection

8 current signals from 0–20 mA may be connected to the IBC AI 5 analog input module. To eliminate external interference signals from the analog signal, the module inputs have an integrated low pass filter. The input signals are isolated from the Bitbus as well as from the supply voltage. Terminal assignment of the various analog signals is illustrated in the figures on the right.





MODULES

Command List IBC AI

Additional Phoenix Commands

Write Parameter for Channel Gain

- Allows to modify the gain of analog input channels

Read Analog Channels

- Allows the user to read the data of an analog channel group

Read Analog Channels with Gain

- Allows to read the data and gain of a group of analog channels

Read Analog Channels Average

- Allows to read the average of an analog channel of a group

Emergency-mode Processing

- Allows emergency-mode processing (release/enable)

The Intel 8044 microcontroller supports all analog input modules. This, in its double function, also performs the complete data preprocessing.

The Intel real-time DCX 51 operating system is integrated in the module firmware. The open software concept is the basis for user program implementation. The additional tasks do not only offload the master computer but simultaneously improve the response time behavior for time critical applications.

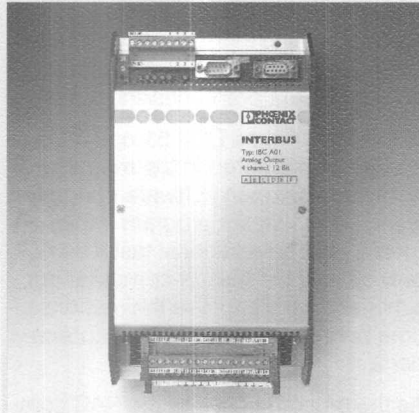
As the present scope of the RAC commands does not fully harness the modules' efficiency and intelligence, the Phoenix commands listed on the left have been included in the module firmware. The command list extension eases operation, particularly for industrial users. All extensions are implemented so as to match the standard Intel concept. The extension commands are operated with the existing Bitbus software and can be used by various master systems.

For detailed description of the Phoenix commands please refer to chapter "Programming", beginning from page 76.



MODULES

Analog Output



Complex control and regulating processes require the preset of analog manipulated variables. The INTERBUS-C analog output modules convert digitized analog values from the host into standardized analog signals, the latter being transmitted directly to the analog actuators. Digital serial transmission eliminates interferences and loss when transmitting analog signals via long cables. Analog signals are generated only directly in the field – where they are needed.

The INTERBUS-C modules meet the Intel Bitbus specifications and operate as intelligent slaves in every Bitbus network. The integrated Intel 8044 processor assumes network coupling as well as analog output module control.

A 32 kByte-RAM memory area and the Intel DCX real-time operating system guarantee the implementation of user-specific function blocks on the module. Thus, the module's intelligence can be fully utilized.

The INTERBUS-C analog output modules provide all standardized analog signals from 12 bit precise host presets.

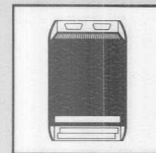
Each of the eight analog outputs uses separate voltage, current and grounding connections. An electronic fusing protects the outputs against short-circuit or overload.

Ordering Data

	Type	Order No.
Analog output ± 10 V, 0–20 mA incl. users manual	IBC AO1	27 85 39 4
Analog output 0–10 V, 4–20 mA incl. users manual	IBC AO2	27 85 40 4
Additional users manual for IBC AO	IBC UAO	27 85 67 9

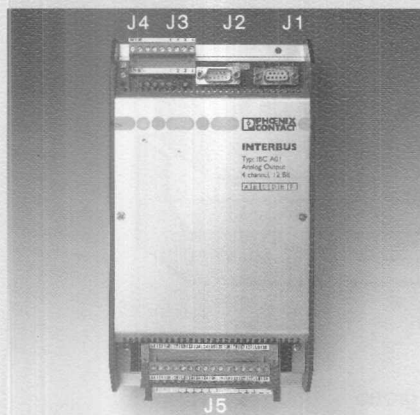
Technical Specifications

	IBC AO1	IBC AO2
Analog Outputs		
Output ranges	± 10 V; 0–20 mA	0–10 V; 4–20 mA
Number of current/voltage outputs	8	
Resolution	12 bit	
Galvanic isolation		
– Bus/Periphery	2.5 kV	
– Operating voltage/Inputs	Yes	
Voltage Outputs		
Output voltage range	± 10 V	0–10 V
Output current	5 mA	5 mA
Short-circuit protection		Electronic
		Short-circuit proof
Linearity		± 1 LSB
Output resistance		2 kOhm
Current Outputs		
Output current range	0–20 mA	4–20 mA
Linearity		± 2 LSB
Output resistance		Max. 300 Ohm
Supply voltage	24 V DC $\pm 10\%$	
Current consumption	700 mA	
Housing dimensions (D x W x H) in mm	245 x 129 x 66	



MODULES

Analog Output



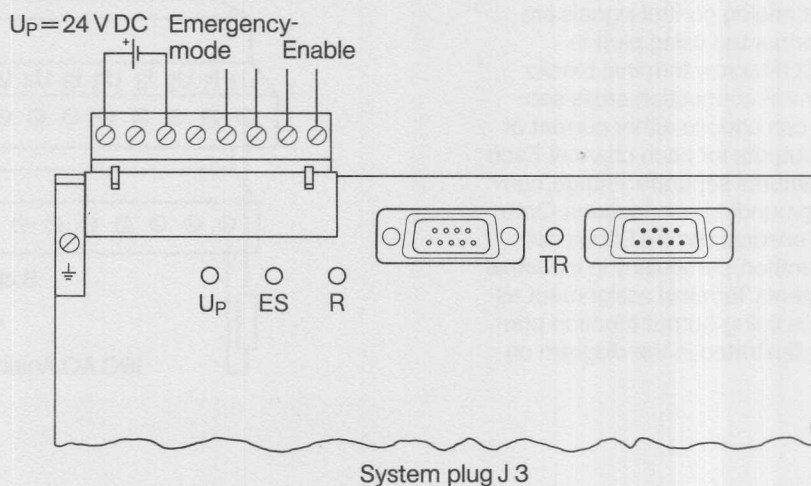
- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Grounding wire connection
- J 5 Output group

In order to exclude external interference signals from the beginning which could provoke analog signal distortion, all analog outputs are isolated from the Bitbus as well as from the external supply voltage.

Analog signal line connection is effected via easy-to-service plug-in COMBICON screw terminal blocks using the 2-wire connection technique. In addition to all Intel RAC commands the internal module firmware supports the reading of the module's identification as well as the programming of the individual analog output channels.

The Bitbus connection is a 9 position D-Sub plug connector (J 1 and J 2).

The connection of the control values (as voltage or current signals) is made fail-safe through plug-in COMBICON screw terminal blocks (J 5). Terminal assignment for the analog signal lines is documented in detail on the following pages.



The supply voltage of the module as well as the emergency-stop and enabling output are wired on the system plug (J 3).

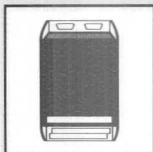
Colored diagnostic LEDs indicate the correctly applied operating voltage, the status of the emergency-mode inputs and signal the transmit mode via a special Transmit-LED. An external grounding wire up to 4 mm² conductor cross section can be connected via a separate terminal block.

U_P = Module supply voltage

ES = Emergency-stop
LED on: Operating status
LED off: Module in emergency-stop

R = Reset
LED on: Supply voltage correct
LED off: Module reset

TR = Transmit
LED on: Module transmits a message.

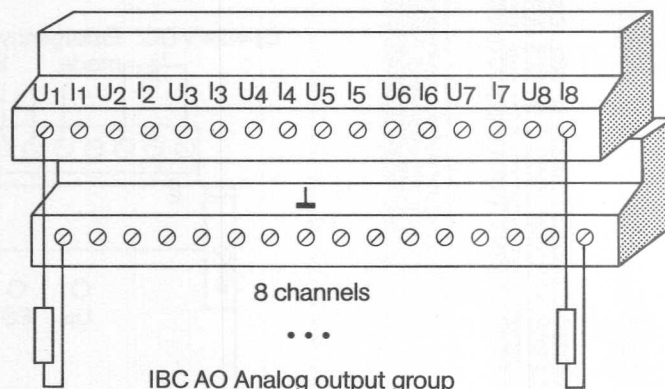


MODULES

Analog Output

Analog Control Signal Connection

The eight analog control signals are 2-wire connected using plug-in COMBICON screw terminal blocks with 2.5 mm² connection cross section. You can choose either current or voltage outputs for each channel. Each output features separate voltage, current and grounding connections. Opto-isolation ensures secure Bitbus network operation, particularly in industrial environments. Terminal assignment as well as the analog output function principle are illustrated in the diagram on the right.



Command List IBC AO

The Intel 8044 microcontroller supports all analog output modules. In addition to its function as network coupling unit, the microcontroller also performs the complete data preprocessing.

The Intel real-time DCX 51 operating system is integrated in the module's firmware. The open software concept is the basis for implementing user programs. These additional tasks do not only offload the master computer, but simultaneously enhance the response time behavior for time critical applications.

The INTERBUS hardware conception along with the Intel RAC commands allow for easy handling of the INTERBUS-C analog output modules. The module software extensions are implemented so as to match the standard Intel concept. All extension commands are operated with the existing Bitbus software and can be used by various master systems.

Please refer to the chapter "Programming" beginning from page 76 for detailed description of the Phoenix commands.

Additional-Phoenix-Commands

Write Analog Channels

- Allows the user to write data to a group of analog channels.

Emergency-mode Processing

- Allows emergency-mode processing (release/enable)

Introduction to the Course

The purpose of this course is to provide a comprehensive overview of the field of study. It is designed for students who are new to the subject and want to gain a solid foundation in the key concepts and theories. The course will cover a wide range of topics, from the historical development of the field to the latest research findings. By the end of the course, students should be able to identify the major areas of research, understand the underlying principles, and apply this knowledge to solve problems. The course is structured to be both informative and engaging, with a mix of lectures, readings, and practical exercises. Students are encouraged to participate actively in the learning process and to seek out additional resources to deepen their understanding.

The course is divided into several modules, each focusing on a specific aspect of the field. The first module, which we are currently in, introduces the course and provides an overview of the topics to be covered. The subsequent modules will delve into the core concepts and theories, exploring their origins and evolution. Each module includes a series of lectures, readings, and exercises designed to reinforce the material. Students are expected to complete these assignments and to engage in discussions with their peers and the instructor. The course is designed to be flexible, allowing students to progress at their own pace and to seek out additional resources as needed. The final module will provide a summary of the key findings and a look at the future of the field.

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Module	Topic	Duration
1	Introduction to the Course	1 hour
2	History of the Field	2 hours
3	Core Concepts and Theories	3 hours
4	Research Methods	2 hours
5	Current Research Findings	2 hours
6	Future of the Field	1 hour

The course is designed to be both informative and engaging, with a mix of lectures, readings, and practical exercises. Students are encouraged to participate actively in the learning process and to seek out additional resources to deepen their understanding.

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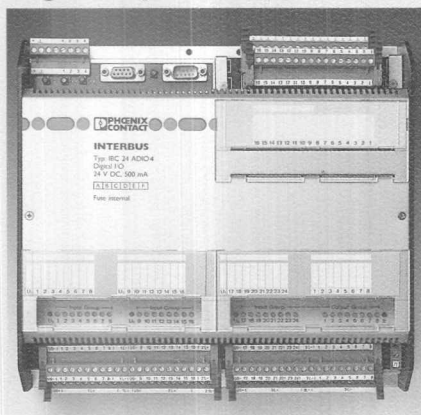
Module	Topic	Duration
1	Introduction to the Course	1 hour
2	History of the Field	2 hours
3	Core Concepts and Theories	3 hours
4	Research Methods	2 hours
5	Current Research Findings	2 hours
6	Future of the Field	1 hour

The course is designed to be both informative and engaging, with a mix of lectures, readings, and practical exercises. Students are encouraged to participate actively in the learning process and to seek out additional resources to deepen their understanding.



MODULES

Analog Input – Digital Input/Output



More power in a compact format – up to 48 digital and analog process signals can be connected to the module. The INTERBUS-C I/O module is installed in close proximity of the sensors and actuators as a compact I/O Bitbus slave and is directly connected to the Bitbus. The I/O modules conform to the Intel Bitbus specifications. The module's intelligence conditions the field signals for bus transmission. As an intelligent slave the I/O station can also be used for data preprocessing, thus off-loading host and network. The compact digital-analog I/O module always provides a wide range of technical and economical leeway, whenever many I/O signals have to be connected to the network. The I/O interface divides into:

- 24 binary inputs
- 8 binary outputs
- 16 analog inputs

The analog signals can be wired as 16 single-ended or 8 differential inputs. All standardized analog signals are processed by the module control electronics.

The module-integrated control logic converts the analog signals into floating 12 bit digital information. The digitized measured values are stored in the module and can be polled from the host at any time.

The very short internal cycle time allows to acquire very fast signals.

Ordering Data

	Type	Order No.
Analog/Digital I/O		
0–10 V differential	IBC 24 ADIO 1	27 85 03 5
± 10 V differential	IBC 24 ADIO 2	27 85 11 6
0–10 V single ended	IBC 24 ADIO 3	27 85 12 9
± 10 V single ended	IBC 24 ADIO 4	27 85 13 2
0–20 mA	IBC 24 ADIO 5	27 85 14 5
incl. users manual		
Additional users manual for IBC 24 ADIO	IBC UADIO	27 85 68 2

Technical Specifications

Analog Inputs

Programmable input ranges

Gain 1

Gain 10

Gain 100

Number of inputs

Galvanic isolation

– Bus/Periphery

– Operating voltage/Inputs

Input resistance

Connection method of sensors

Measuring value representation 0–10 V

± 10 V

Measuring principle

Conversion time

Permissible voltage between

inputs and housing

Noise suppression

Linearity

Basic error limits

– Gain 1

– Gain 10

– Gain 100

Supply voltage U_p

Current consumption:

Module electronics

Housing dimensions (DxWxH) in mm

IBC 24
ADIO 2/4

IBC 24
ADIO 1/3

IBC 24
ADIO 5

± 10 V

± 1 V

± 100 mV

8 differential or 16 single-ended

2.5 kV

Yes

1 MOhm

2-wire connection

12 bit, binary

12 bit, offset-binary

Free-running conversion with
successive approximation

25 µs

± 35 V (powered)

± 20 V (unpowered)

75 dB min

± 1/2 LSB

± 0.2 ‰

± 1.25 ‰

± 1.6 ‰

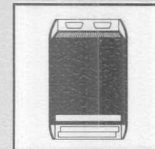
24 V DC ± 10%

700 mA

245x266x66

0–20 mA

50 Ohm



MODULES

Analog Input – Digital Input/Output

With three gain factors the “programmable gain” provides more flexibility during analog signal acquisition. Further function features of the analog interface are as follows:

- High speed due to the use of the most up-to date A/D converters with a conversion time of 25 μ s
- High-precision conversion results due to 12 bit binary representation
- Galvanic isolation between the analog periphery, operating voltage and bus

The digital interface offers 32 inputs/outputs which divide into:

- 3 isolated input groups of 8 for direct 2-wire connection and
- 8 short-circuit proof digital outputs.

For each input group of 8 four 3-wire initiators can be directly connected, i.e. signal, positive and negative lines are directly wired on the compact module. Thereby, wiring complexity and expense are minimized as well as external intermediate terminal points eliminated.

The external supply voltage for the module and the operating voltage for the binary inputs/outputs amount to 24 VDC. The short-circuit proof outputs are rated for a continuous 500 mA load. All I/O channels (including the analog ones) are isolated from the module electronics and the Bitbus. LEDs indicate the signal status of the binary inputs/outputs. For individual labeling of the separate inputs/outputs the module has a large marking field.

Availability as well as overload and short circuit on the outputs are also LED-indicated. The convenient LED diagnostics “on site” eases start-up and servicing.

Technical Specifications

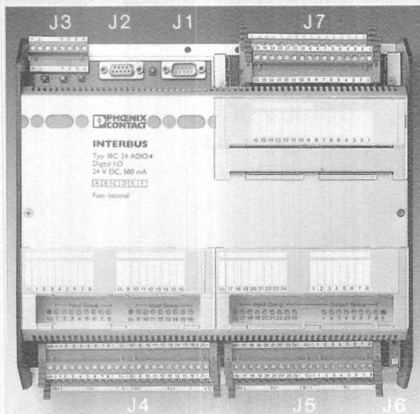
Operating voltage U_S	24 V DC
Permissible range*)	20–30 V DC
Supply voltage U_P	24 V DC $\pm$ 10%
Current consumption: Module electronics	Max. 500 mA
Inputs	
Number of inputs	24
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 8
Input voltage	
– Rated value	24 V DC
– Permissible range for “0” signal	–30 V to +5 V
– Permissible range for “1” signal	13–30 V
Input current per channel	7 mA
Delay time	
– Input groups 1 and 2	3 ms typical
– Input group 3	0–255 ms
Inputs: Initiators	
Number of initiator inputs	12 (3-wire)
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 4
Output voltage for initiators	24 V DC
Short-circuit protection	Fuse 1 A
Outputs	
Number of outputs	8
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Outputs	Yes
Output voltage	24 V DC
Output current	
– Rated value	500 mA
Limitation of voltage induced on circuit interruption	Acc. to VDI 3422
Total load capacity per module	
– at 20° C	4 A
– at 55° C	See derating curve
Short-circuit protection	Electronic
Polarity protection of operating voltage	Fuse 5 A
Signal level of outputs at rated value	$U_S - 1.5$ V
Diagnostics	
– Operating voltage indicator per group	LED green
– Status indicator per input	LED yellow
– Status indicator per output	LED yellow
– Short-circuit/overload indicator of outputs	LED red
Housing dimension (D x W x H) in mm	245 x 266 x 66

*) including ripple



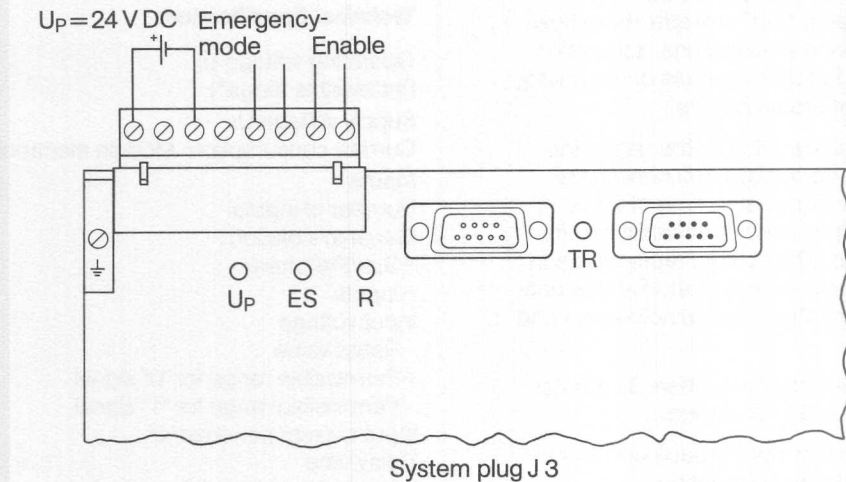
MODULES

Analog Input – Digital Input/Output



- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Input groups 1 and 2
- J 5 Input group 3/
Output group
- J 6 Grounding wire connection
- J 7 Analog input group

Sophisticated galvanic isolation guarantees safe I/O module operation in industrial environments. The external supply voltage is electrically isolated from the module electronics and the Bitbus network through DC/DC converters with two isolated outputs. The isolation with a test voltage of 2.5 kV meets all VDE and IEC requirements for safe multi-user system operation. Additional monitoring functions such as watchdog timer and emergency-mode increase the reliability of the I/O modules. The Intel 8044 microcontroller uses the Intel DCX 51 operating system, thus supporting all Intel RAC commands. Further specified commands considerably increase the industrial application capabilities. The RAC protocol supports these additional functions as well.



- U_P – Module supply voltage
- ES – Emergency-stop
LED on: Operating status
LED off: Module in emergency-stop
- R – Reset
LED on: Supply voltage correct
LED off: Module reset
- TR – Transmit
LED on: Module transmits a message

Additional functions:

- Defining 4 inputs as counters
- Defining 4 outputs as single-shot
- Defining 4 outputs as clock generator
- Defining on-and off-delays for all outputs
- Programmable time delay for all inputs
- Input/output data inversion

The Bitbus cable is connected to the I/O module using the recommended Intel 9 position D-Sub plug connector with shielded housing (J 1 and J 2).

External device connection is achieved via easy-to-service plug-in COMBICON screw terminal blocks (J 4–J 5). Terminal assignment of the inputs and outputs is documented on the following pages.

The signal lines transmitting the analog signals are also wired on plug-in COMBICON screw terminal blocks (J 7). Signal line connection is made directly to the module. The connection possibilities are documented on the following pages.

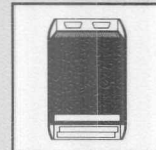
The system plug (J 3) is used for wiring the emergency-mode, the enable output and the external voltage supply.

Colored LEDs signal:

- Operating voltage active
- Status emergency-mode
- Transmit

An external grounding wire up to 4 mm² connection cross section can be connected through a separate terminal block.

A jumper allows to code the required transmission speed (62.5 kBit/s or 375 kBit/s) in the individual INTERBUS-C modules.



MODULES

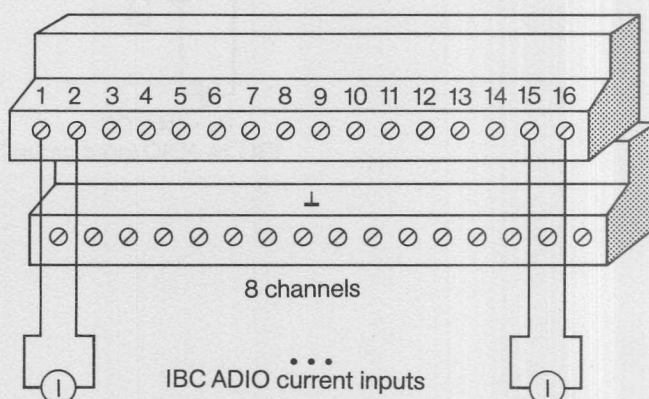
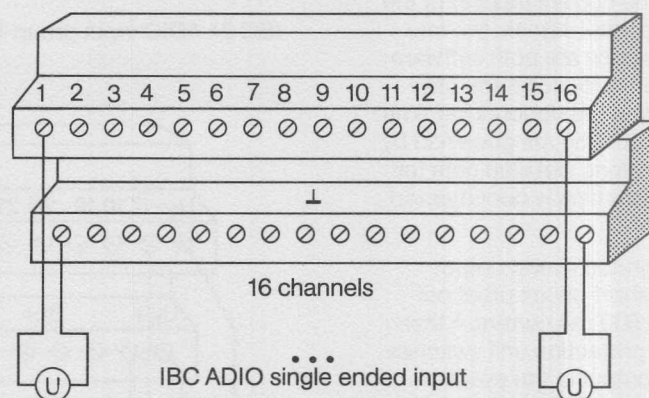
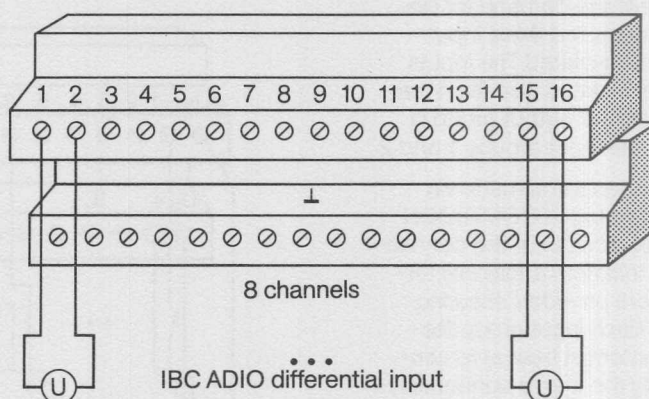
Analog Input – Digital Input/Output

Single-ended/Differential Input Connection

The 16 single-ended or 8 differential signals are 2-wire connected via easy-to-service plug-in COMBICON screw terminal blocks with 2.5 mm² connection cross section. In addition to a protection circuit on every analog input the differential inputs have the advantage that potential differences due to cable lengths do not affect the measurement result. The analog signal inputs are isolated both from the Bitbus and the supply voltage.

Current Input Connection

8 current signals from 0–20 mA may be connected to the IBC AI 5 analog input module. To eliminate external interference signals from the analog signal, the module inputs have an integrated low pass filter. The input signals are isolated from the Bitbus as well as from the supply voltage. Terminal assignment of the various analog signals is illustrated in the figures on the right.





MODULES

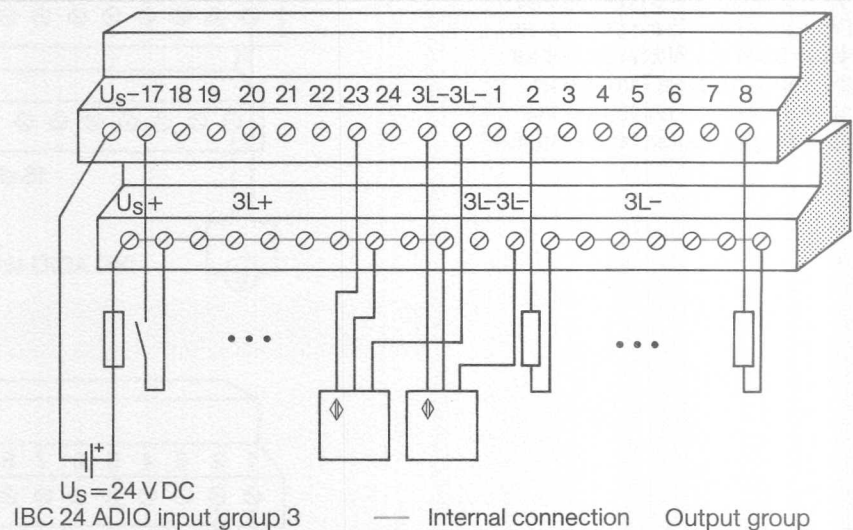
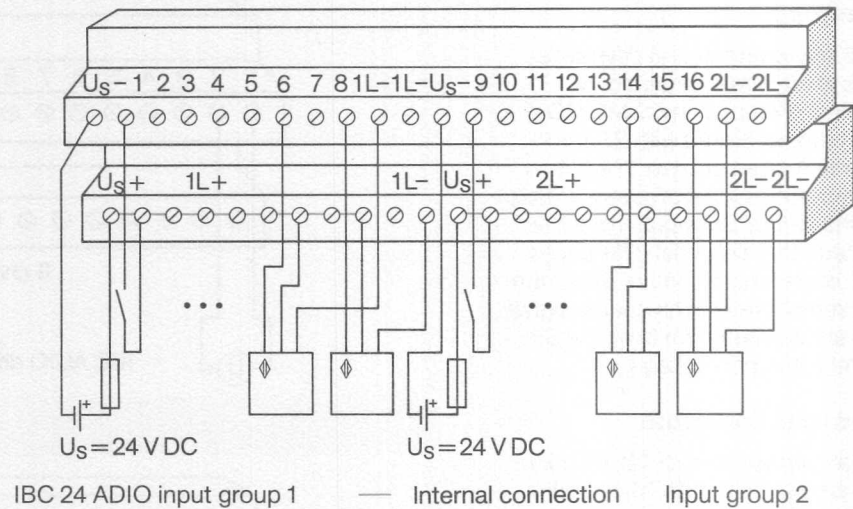
Analog Input – Digital Input/Output

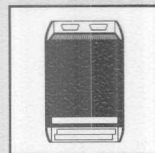
In order to meet the demand for isolated input groups, the three input groups are opto-isolated. The inputs are electrically isolated also from the bus electronics. The output group is isolated from the input groups 1 and 2.

Signal line connection is made via easy-to-service plug-in COMBICON screw terminal blocks. For the connection of 3-wire initiators additional terminal blocks are provided ensuring direct supply. Each input group features a 24 V potential busbar to conveniently apply the 2-wire connection technique.

To exclude any effect of external interferences on the correct reading of the instantaneous input signals, the module's input groups are both software- and hardware-debounced. The user can freely define the debouncing time in the range of 0–255 ms governed by special instructions. Detailed data for module programming is documented on page 76.

By using integrated power output stages, the 8 short-circuit proof outputs supply a 500 mA current. A thermal overload protection unit switches off the faulty output in the event of excessive load. Having eliminated the fault, the output channel automatically switches itself on again.





MODULES

Command List IBC ADIO

Additional Phoenix Commands

Clock Definition

- Allows to specify up to 4 outputs as clock generator ($f_{\max} = 50$ Hz)

Single Shot Definition

- 4 outputs may be assigned the single-shot function

Retriggerable Single Shot

- 4 outputs may be assigned the retriggerable single-shot function

Input/Output Definition

- Allows to invert input/output data in all inputs/outputs

Debounce Time

- All inputs may be assigned variable debouncing times

Switch Definition

- Allows to activate all inputs as dynamic switches

On-Delay/Off-Delay

- All outputs may be assigned flexible on-/off-delays

Counter Definition

- Allows to specify up to 4 digital inputs as counters (max. count value 65535; counting frequency up to 25 Hz)

Read Counter with Set

- Sets a counter to a fixed value at simultaneously reading out the instantaneous count

Read Counter

- Allows to read out a counter

Emergency-mode Processing

- Allows emergency-mode processing (release/enable)

Write Parameter for Channel Gain

- Allows to modify the gain of analog inputs channels

Read Analog Channels

- Allows the user to read the data of an analog channel group

Read Analog Channels with Gain

- Allows to read data and gain of an analog channel group

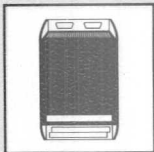
Read Analog Channels Average

- Allows to read an average of an analog channel of a group

In order to support the multiple hardware application capabilities the Intel DCX 51 real-time operating system has been implemented in the firmware of the INTERBUS ADIO modules – managed by the Intel 8044 microcontroller. The open software concept is the basis for implementing user programs. The additional tasks do not only offload the host but simultaneously enhance the response-time behavior for time critical applications.

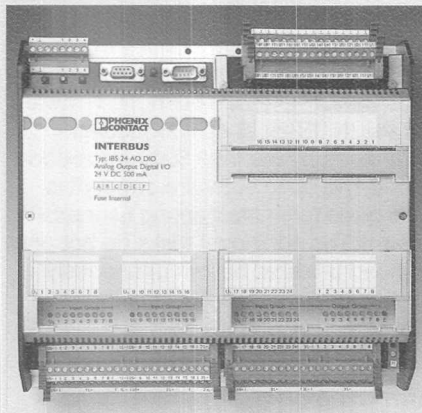
As the present scope of the RAC commands does not fully utilize the modules' capacity and intelligence, the Phoenix commands listed on the left have been included in the module firmware. The extension of the command list simplifies operation, particularly for industrial users. All extensions are implemented, so as to match the standard Intel concept. The extension commands are operated with the existing Bitbus software and can be used by various master systems.

Please refer to the chapter "Programming" beginning from page 76 for detailed description of the Phoenix commands.



MODULES

Analog Output-Digital Input/Output



Up to 40 digital and analog process signals can be processed using this compact INTERBUS-C-I/O module. As a Bitbus slave it is installed in the direct vicinity of the sensors and actuators and connected directly to the Bitbus. The Intel 8044 microcontroller assumes network coupling. Thus, all Intel Bitbus specifications are met and the IBC 24 AODIO module can be integrated in any Bitbus network.

Further to execute interface handling tasks, the 8044 microcontroller almost exclusively assumes the field signal data preprocessing. This helps user specific data preprocessing functions already run in the intelligent I/O stations, thus offloading the Bitbus network and the host computer.

A hardware that meets industrial requirements and the real-time operating system of the INTERBUS-C module allow for economic and technical leeway when utilizing the

- 24 binary inputs,
- 8 binary outputs,
- 8 analog outputs.

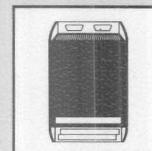
Each of the 8 analog outputs features separate voltage, current and ground-ing connections. The analog output interface converts digital host presets with 12 bit resolution into all standardized output signals. For the I/O modules the intelligent Bitbus I/O slave provides these signals - as continuous preset of analog manipulated variables - in complex control and regulating functions as a supplement to digital I/O values directly to the process periphery.

Ordering Data

	Type	Order No.
Analog/Digital I/O ± 10 V, 0-20 mA incl. users manual	IBC 24 AODIO 1	27 85 41 7
Analog/Digital I/O 0-10 V, 4-20 mA incl. users manual	IBC 24 AODIO 2	27 85 42 0
Additional users manual for IBC AODIO	IBC UAODIO	27 85 69 5

Technical Specifications

Technical Specifications	IBC 24 AODIO 1	IBC 24 AODIO 2
Analog Outputs		
Output ranges	± 10 V; 0–20 mA	0–10 V; 4–20 mA
Number of current/ voltage outputs	8	
Resolution	12 bit	
Galvanic isolation		
– Bus/Periphery	2.5 kV	
– Operating voltage/Inputs	Yes	
Voltage Outputs		
Output voltage range	± 10 V	0–10 V
Output current	5 mA	5 mA
Short-circuit protection	Electronic Short-circuit proof	
Linearity	± 1 LSB	
Output resistance	2 kOhm	
Current Outputs		
Output current range	0–20 mA	4–20 mA
Linearity	± 2 LSB	
Output resistance	300 Ohm	
Supply voltage	24 V DC ± 10%	
Current consumption	700 mA	
Housing dimensions (DxWxH) in mm	245x266x66	



MODULES

Analog-Output – Digital Input/Output

Providing four analog output ranges the INTERBUS-C module covers all standard manipulated variables for industrial applications. Further function features of the analog-output interface are as follows:

- The 8 output channels are isolated from the operating voltage and the Bitbus
- Separate 12 bit digital/analog converters for each voltage/current output
- Separate voltage, current and grounding connections for every output channel

The digital interface has 32 inputs/outputs which divide into:

- 3 isolated input groups of 8 for direct 2-wire connection and
- 8 short-circuit proof digital outputs.

For each input group of 8, four 3-wire initiators can be directly connected, i.e. signal, positive and negative lines are wired directly to this compact module, thus minimizing wiring complexity and expense as well as eliminating external intermediate terminal points.

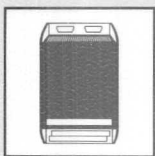
The external supply voltage for the module and the operating voltage for the binary inputs/outputs amount to 24 V DC. The short-circuit proof outputs are rated for a continuous 500 mA load. All I/O channels (including the analog ones) are isolated from the module electronics and the Bitbus. LEDs indicate the signal status of the binary inputs/outputs. For individual labeling of the separate inputs/outputs the module features a large marking field.

Availability as well as overload and short-circuit on the outputs are also LED-indicated. The convenient LED diagnostics "on site" eases start-up and servicing.

Technical Specifications

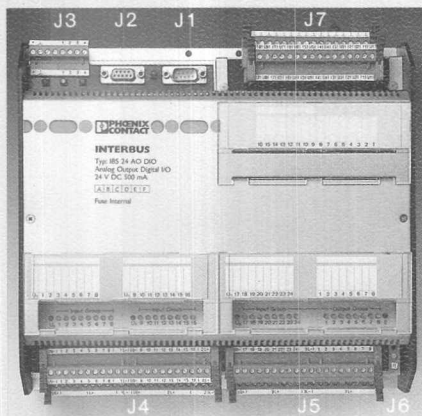
Operating voltage U_S	24 V DC
Permissible range*)	20–30 V DC
Supply voltage U_P	24 V DC $\pm$ 10%
Current consumption: Module electronics	Max. 500 mA
Inputs	
Number of inputs	24
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 8
Input voltage	
– Rated value	24 V DC
– Permissible range for "0" signal	–30 V to +5 V
– Permissible range for "1" signal	13–30 V
Input current per channel	7 mA
Delay time	
– Input groups 1 and 2	3 ms typical
– Input group 3	0–255 ms
Inputs: Initiators	
Number of initiator inputs	12 (3-wire)
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Inputs	In groups of 4
Output voltage for initiators	24 V DC
Short-circuit protection	Fuse 1 A
Outputs	
Number of outputs	8
Galvanic isolation	
– Bus/Periphery	2.5 kV
– Outputs	Yes
Output voltage	24 V DC
Output current	
– Rated value	500 mA
Limitation of voltage induced on circuit interruption	
Total load capacity per module	Acc. to VDI 3422
– at 20° C	4 A
– at 55° C	See derating curve
Short-circuit protection	Electronic
Polarity protection of operating voltage	Fuse 5 A
Signal level of outputs at rated value	$U_S - 1.5 V$
Diagnostics	
– Operating voltage indicator per group	LED green
– Status indicator per input	LED yellow
– Status indicator per output	LED yellow
– Short-circuit/overload indicator of outputs	LED red
Housing dimensions (D x W x H) in mm	245 x 266 x 66

*) including ripple



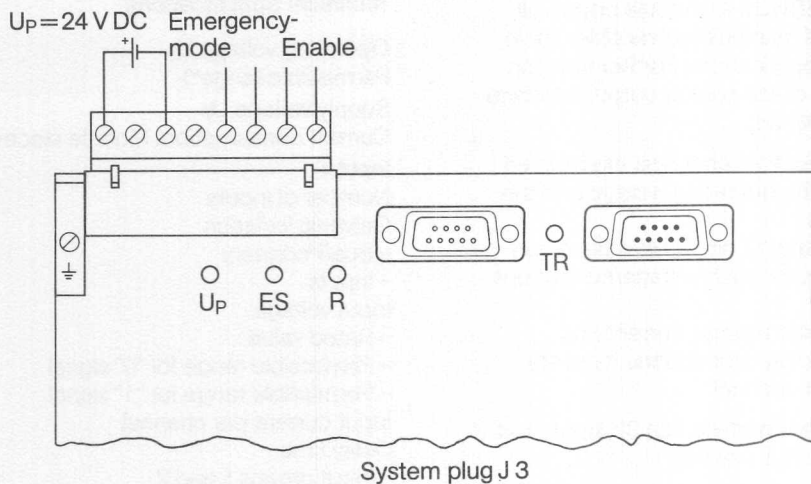
MODULES

Analog Output – Digital Input/Output



- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Input groups 1 and 2
- J 5 Input group 3/
Output group
- J 6 Grounding wire connection
- J 7 Analog input group

Safe I/O module operation in industrial environments is guaranteed due to a sophisticated galvanic isolation. The external supply voltage is electrically isolated from the module electronics and the Bitbus network through DC/DC converters with two isolated outputs. The isolation with a test voltage of 2.5 kV meets all VDE and IEC requirements for safe multi-user system operation. Additional monitoring functions such as watchdog timer and emergency-mode increase the reliability of the I/O modules. The Intel 8044 microcontroller uses the Intel DCX 51 operating system, thus supporting all Intel RAC commands. Furthermore, commands have been specified, which considerably increase the industrial application possibilities. The RAC protocol supports these additional functions as well.



- Up – Module supply voltage
- ES – Emergency-mode, LED on: Operating state, LED off: Module in emergency-stop
- R – Reset, LED on: Supply voltage correct, LED off: Module reset
- TR – Transmit, LED on: Module transmits a message

Additional functions:

- Defining 4 inputs as counters
- Defining 4 outputs as single-shot
- Defining 4 outputs as clock generator
- Defining on- and off-delays for all outputs
- Input/output data inversion

The Bitbus cable is connected to the I/O module using the recommended Intel 9 position D-Sub plug connector with shielded housing (J 1 and J 2).

External device connection is achieved via easy-to-service plug-in COMBICON screw terminal blocks (J 4–J 5). Terminal assignment of the inputs and outputs is documented on the following pages.

The signal lines transmitting the analog signals are also wired on plug-in COMBICON screw terminal blocks (J 7). Signal line connection is made directly to the module. The connection possibilities are documented on the following pages.

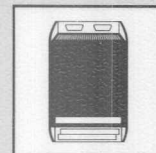
The system plug (J 3) is used for wiring the emergency-mode, the enable output and the external voltage supply.

Colored LEDs signal:

- Operating voltage active
- Status emergency-mode
- Transmit

An external grounding wire up to 4 mm² connection cross section can be connected through a separate terminal block.

A jumper allows to code the required transmission speed (62.5 kBit/s or 375 kBit/s) in the individual INTERBUS-C modules.

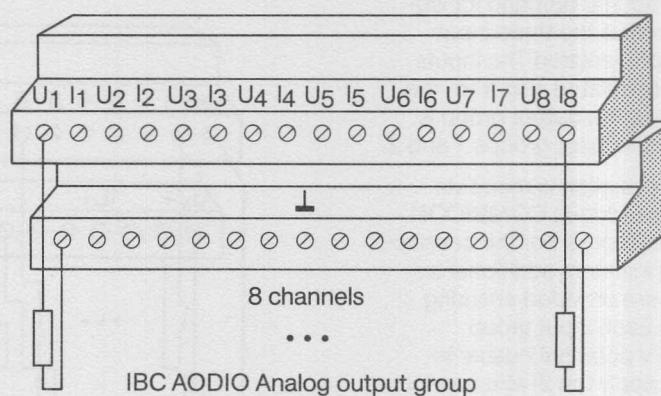


MODULES

Analog Output – Digital Input/Output

Analog Control Signal Connection

The eight analog control signals are 2-wire connected through plug-in COMBICON screw terminal blocks with 2.5 mm² connection cross section. Either current or voltage outputs can be chosen for each channel. Each output features a separate voltage, current and grounding connection. Optical isolation ensures secure Bitbus network operation, particularly in industrial environments. Terminal assignment of the analog outputs is shown in the diagram on the right.





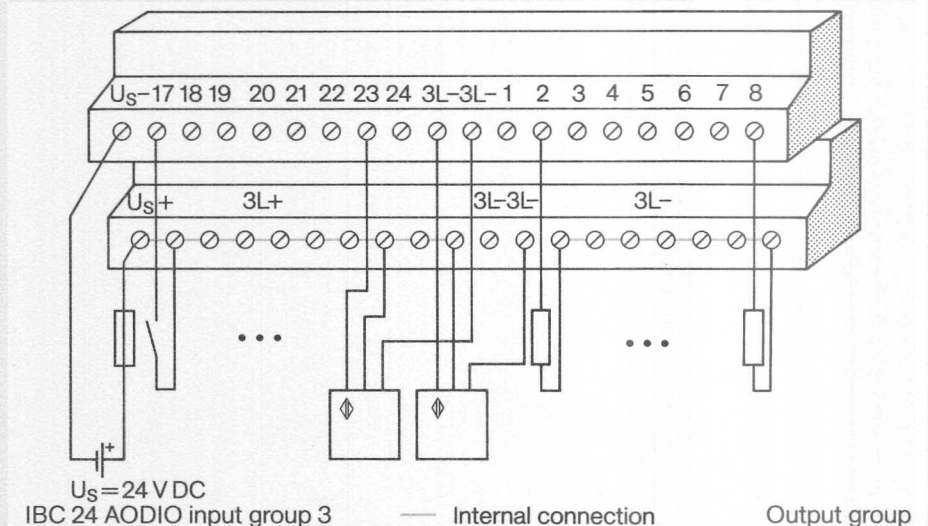
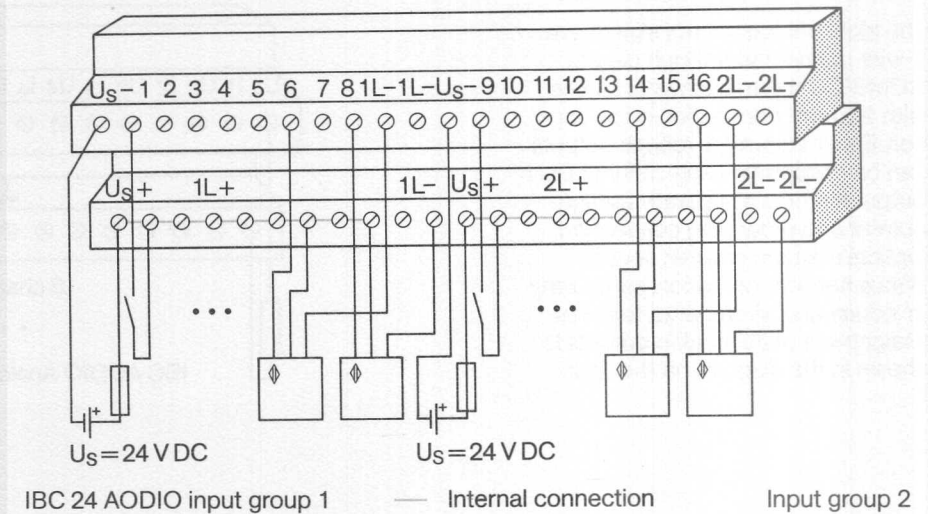
MODULES

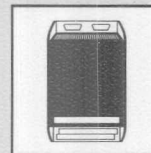
In order to meet the demand for isolated input groups, the three input groups are opto-isolated. The inputs are electrically isolated also from the bus electronics. The output group is isolated from the input groups 1 and 2.

Signal line connection is made via easy-to-service plug-in COMBICON screw terminal blocks. For the connection of 3-wire initiators additional terminal blocks are provided ensuring direct supply. Each input group features a 24 V potential busbar to conveniently apply the 2-wire connection technique.

To exclude any effect of external disturbance influences on the correct reading of the instantaneous input signals, the module's input groups are both soft- and hardware-debounced. The user can freely define the debouncing time in the range of 0–255 ms governed by special instructions. Detailed data for module programming is documented on page 76.

By using integrated power output stages, the 8 short-circuit proof outputs supply a 500 mA current. A thermal overload protection unit switches off the faulty output in the event of excessive load. Having eliminated the fault, the output channel automatically switches itself on again.





MODULES

Command List IBC 24 AODIO

Additional Phoenix Commands

Clock Definition

- Allows to specify up to 4 outputs as clock generator ($f_{\max.} = 50 \text{ Hz}$)

Single Shot Definition

- 4 outputs may be assigned the single-shot function

Retriggerable Single Shot

- 4 outputs may be assigned the retriggerable single-shot function

Input/Output Definition

- Allows to invert the input/output data in all inputs/outputs

Debounce Time

- All inputs may be assigned variable debouncing times

Switch Definition

- Allows to activate all inputs as dynamic switches

On-Delay/Off-Delay

- All outputs may be assigned flexible on-/off-delays

Counter Definition

- Allows to specify up to 4 inputs as counters (max. count value 65535; counting frequency up to 25 Hz)

Read Counter with Set

- Sets a counter to a fixed value at simultaneously reading out the instantaneous count

Read Counter

- Allows to read out a counter

Emergency-mode Processing

- Allows emergency-mode processing (release/enable)

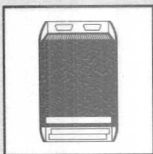
Write Analog Channels

- Allows the user to write data to an analog channel group

In order to support the multiple hardware application capabilities the Intel DCX 51 real-time operating system has been implemented in the firmware of the INTERBUS AODIO modules – managed by the Intel 8044 microprocessor. The open software concept is the basis for implementing user programs. The additional tasks do not only offload the host but simultaneously enhance the response-time behavior for time critical applications.

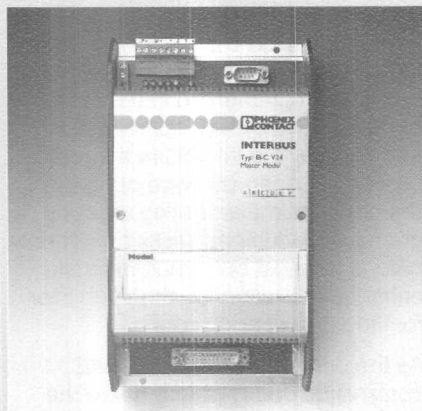
As the present scope of the RAC commands does not fully utilize the modules' capacity and intelligence, the Phoenix commands listed on the left have been included in the module firmware. The extension of the command list simplifies operation, particularly for industrial users. All extensions are implemented, so as to match the standard Intel concept. The extension commands are operated with the existing Bitbus software and can be used by various master systems.

Please refer to the chapter "Programming" beginning from page 76 for detailed description of the Phoenix commands.



MODULES

Communication – Interface Module V.24 (RS-232-C)



The Bitbus is the easy-to-service and convenient connection between host computer and intelligent "Front-End" system devices. Formerly, data exchange between host and external devices was made in star configuration through the RS-232-C (V.24) receiving and transmitting lines. Disadvantage: Only short distances (up to 10 m) could be bypassed, cabling was effected using the star connection. The number of devices to be connected is thus limited by the number of host interface slots.

Interconnection of multiple intelligent systems is only economically feasible using one bus system. Since not all peripheral devices are equipped with a bus interface, they still require a standard V.24 (RS-232-C) interface to be able to connect to the standardized bus systems. For this reason, INTERBUS-C provides the V.24 (RS-232-C) communication interface module which helps link computers, controllers, printers, regulators and other systems featuring a V.24 (RS-232-C) interface to the Bitbus network. As a "Terminal Server" this INTERBUS module performs the handling between the slow V.24 (RS-232-C) data transmission and the communication via the Bitbus. Thus systems of various manufacturers can be connected to open networks by harnessing joint standards. In industrial automation the INTERBUS-V.24 (RS-232-C) communication interface module offers hardware independence to a great extent.

The INTERBUS-C V.24 (RS-232-C) communication interface modules are

Ordering Data

	Type	Order No.
Communication module 2x V.24 (RS-232-C) incl. users manual	IBC V.24	27 85 07 7
Additional users manual for IBC V.24 (RS-232-C)	IBC UV.24	27 85 70 5

Technical Specifications

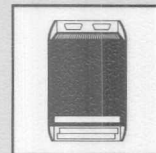
Operating voltage U_S	24 V DC $\pm$ 10%
Current consumption	720 mA
Number of V.24/RS-232 C ports	2 channels which can be programmed independent of each other
Data transmission mode	Full duplex
Asynchronous operation	
– Number of data bits	5, 6, 7 or 8 data bits programmable
– Number of stop-bits	1 or 2 programmable
– Parity	Even, Odd or No Parity programmable
– Baud rate	110 baud up to 19.2 kbaud programmable
– Error detection	Parity error, overflow, frame error
Interrupt processing	Possible
Remote data transmission capability	Modem control function for both channels prepared
Housing dimensions (D x W x H) in mm	245 x 129 x 66

directly connected to the Intel Bitbus. The internal 8044 microcontroller as well as the Intel DCX 51 real-time operating system may be used for user-specific data preprocessing functions due to its independently operating Bitbus interface. Supported by the Intel DCX 51 real-time operating system the following functions are possible:

- Program download to machine tools.
- Download of problem oriented function blocks in the form of independently operating tasks.
- Parametrization of various data transmission protocols.

A 2 kByte-test memory is provided as transmit/receive buffer for every V.24 (RS-232-C) interface.

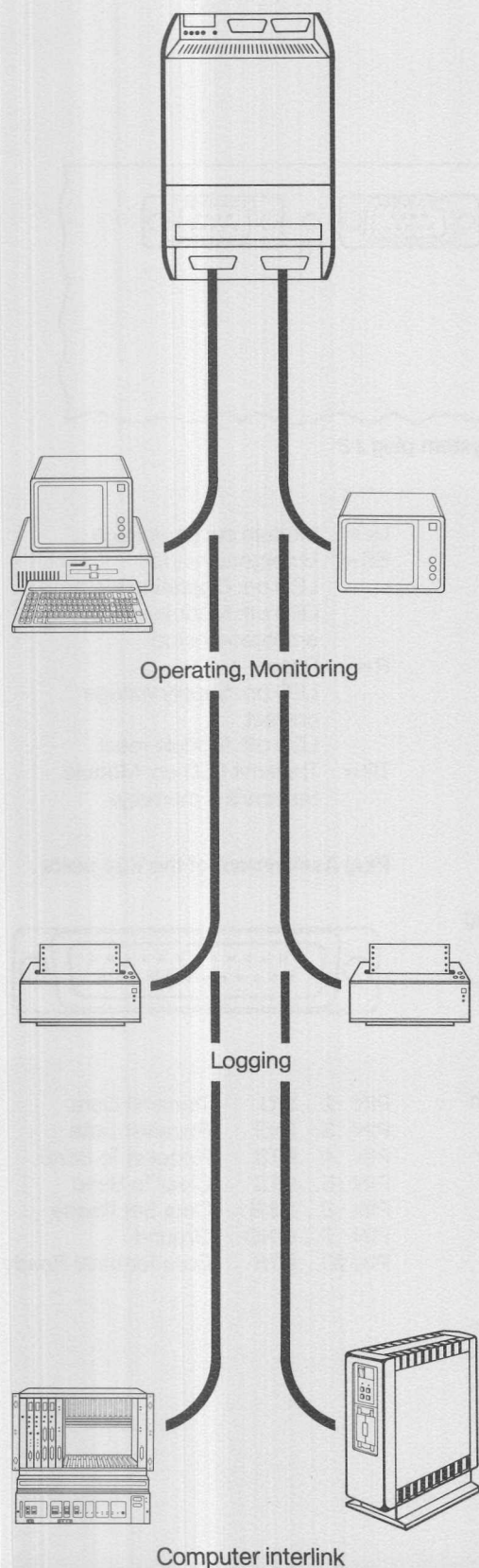
A sophisticated galvanic isolation of the various electric circuits ensures safe INTERBUS-C V.24 (RS-232-C) communication interface module operation. The operating voltage is both electrically isolated from the module electronics and the Bitbus network using a DC/DC converter with two isolated outputs. The galvanic isolation rated for 2.5 kV test voltage meets all VDE and IEC regulations for safe multi-user system operation.



MODULES

V.24 (RS-232-C) Communication Interface Module

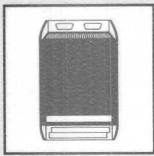
Wherever, in addition to digital and analog process data, intelligent external devices are embedded in the Bitbus network the IBC-V.24 (RS-232-C) communication interface module can be applied. It is used where operating, monitoring and logging tasks as well as computer system interconnection are required.



Screen-based operating and monitoring functions realized by using a V.24 (RS-232-C) terminal and colored process display systems, have become standard in industrial automation. Thus, system data and control commands become transparent within the production cell and are included in the control and production process. The IBC-V.24 (RS-232-C) module represents the interface required for these applications.

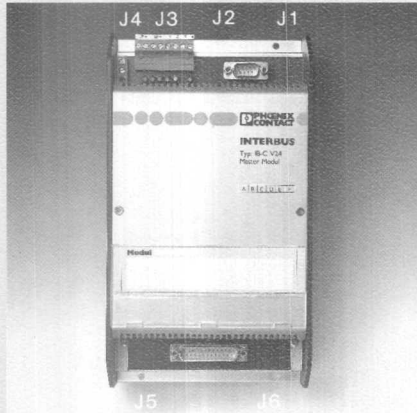
Production and control protocol requirements are permanently increasing depending on the degree of automation. The V.24 (RS-232-C) interface module allows to log data where they are required – in the machine or the production plant. Moreover, the module helps include printer listing and screen logging into the existing automation concept.

Communication and data transport at all levels – above all without computer dependent interfaces – guarantees an open, expandable and industrial network. The use of a V.24 (RS-232-C) interface module as intelligent slave in an open network allows for easy non-proprietary computer system interconnection. Network data can thus be stored e.g. redundantly or transmitted to networks of the upper layers.



MODULES

V.24 (RS-232-C) Communication Interface Module



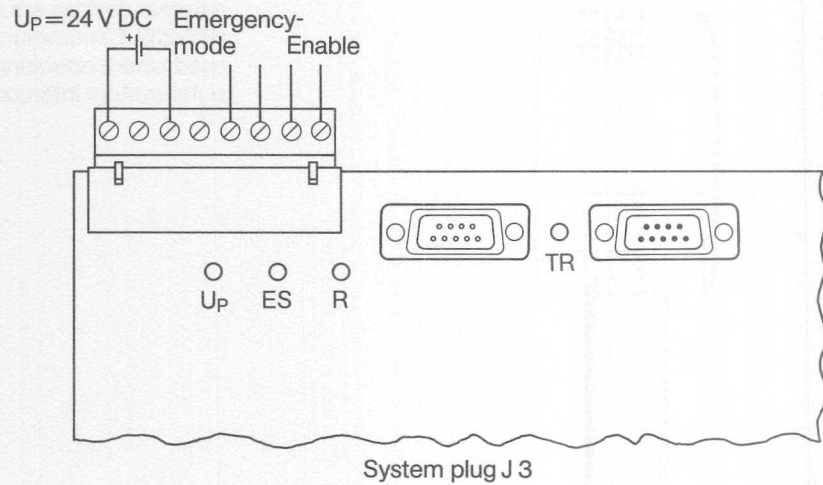
- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Grounding wire connection
- J 5 V.24/RS-232-C channel A
- J 6 V.24/RS-232-C channel B

Safe operation of the INTERBUS-C communication interface module in industrial environments is achieved through a sophisticated galvanic isolation. The external module supply is isolated both from the module electronics and the Bitbus network through a DC/DC converter. The module with a 2.5 kV test voltage complies with all VDE and IEC requirements for safe multi-user system operation.

The Bitbus cable is connected to the I/O modules (J 1 and J 2) through the Intel recommended 9 position D-Sub plug connector with shielded housing. The wiring of the emergency-mode, the enable output and the external voltage supply is made through the system plug (J 3).

Colored diagnostic LEDs indicate:

- Operating voltage active
- Emergency-mode
- Transmit



- U_P = Module supply voltage
- ES = Emergency-stop
LED on: Operating state,
LED off: Module in
emergency-stop
- R = Reset
LED on: Supply voltage
correct
LED off: Module reset
- TR = Transmit LED on: Module
transmits a message

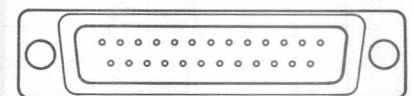
External devices are connected through the two independent V.24 (RS-232-C) interfaces (J5 and J6) using 25 position D-Sub-plugs.

In addition to the Bitbus standard functions, INTERBUS-C offers further extension commands, which are supported by the module firmware:

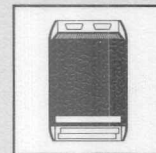
- Two V.24/RS-232-C-interfaces which can be configured separately
- Programmable baud rate, 110 baud – 19.2 kbaud
- Hardware-handshake RTS, CTS
- Programmable parity (Even, Odd or No Parity)

Thus, all commercially available data processing equipment using a serial interface can be connected to the Bitbus system through this INTERBUS-C module.

Plug Assignment of the V.24 ports



PIN 2...	TxD	Transmit Data
PIN 3...	RxD	Receiver Data
PIN 4...	RTS	Request To Send
PIN 5...	CTS	Clear To Send
PIN 6...	DSR	Data Set Ready
PIN 7...	GND	Ground
PIN 20...	DTR	Data Terminal Ready



MODULES

Command List IBC V.24 (RS-232-C)

Additional Phoenix Commands

Configure Channel A

- Allows the configuration of the V.24/RS-232-C interface A

Configure Channel B

- Allows the configuration of the V.24/RS-232-C interface B

Read Channel A

- Allows to read data out of the FIFO memory A

Write Channel A

- Allows to write data to the FIFO memory of interface A

Read Channel B

- Allows to read data out of the FIFO memory B

Write Channel B

- Allows to write data to the FIFO memory of interface B

Read DSR Channel A

- Allows to read the signal DATA SET READY

Read DSR Channel B

- Allows to read the signal DATA SET READY

In addition to user-related parametering functions of the V.24 (RS-232-C) interface the IBC V.24 (RS-232-C) module firmware contains the Intel DCX 51 real-time operating system. The module uses the Intel 8044 as a processor. This is the basis for implementing the user program. Sub-routines on the module offload the host and enhance the response time behavior of the network for time-critical applications.

As the present scope of the RAC commands does not fully utilize the capacity and intelligence of the modules, the Phoenix commands shown on the left have been included in the module firmware. The extension of the command list eases operation, particularly for industrial users. All extensions are implemented, so as to match the standard Intel concept. The extension commands are operated with the existing Bitbus software and can be used by various master systems.

Please refer to the chapter "Programming" beginning from page 76 for detailed description of the Phoenix commands.

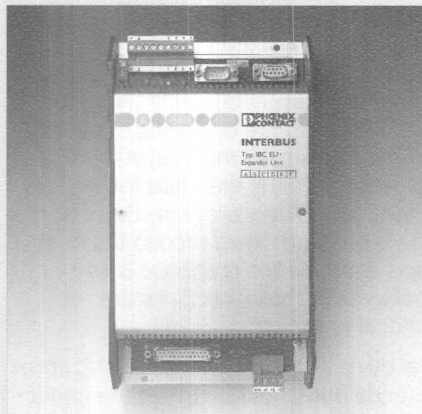
In addition to the standard V.24 (RS-232-C) functions, special protocols such as the Siemens DUST-protocol can be implemented in the firmware of the IBC V.24 (RS-232-C) communication interface module. Thus, Siemens SIMATIC S5-programmable controllers can be linked directly to the Bitbus network.

Implementation of the protocol mentioned above and further protocols is made on request.



MODULES

I/O-Expander Module



The INTERBUS-C I/O expander module has been designed to economically integrate system parts into bus systems in which centralized and not distributed process signals, e.g. in control rooms, predominate. Thus a low-cost connection of up to 256 I/O signals via four input/output modules with up to 64 I/O channels each is possible.

The I/O modules are linked to the expander module which operates as a slave in the Bitbus network via a local bus. The local bus covering a max. length of 4 m is designed as a cycle bus or flat cable bus.

The expander module as well as the digital input/output modules for 24 V DC conform to the same sophisticated security standards as all INTERBUS-C products:

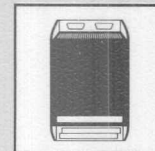
- Galvanic isolation of 2.5 kV between Bitbus network and module electronics of the expander module
- Optical isolation between expander module and parallel bus
- Automatic monitoring of the input/output modules connected to the parallel bus
- Automatic read-in of the parallel bus module configuration for diagnostic functions
- Optical display of the INTERBUS module operating state
- Watch-dog circuit and emergency-mode for increased security concepts in distributed networks
- High-protection against interferences in industrial environments using different parallel bus cables

Ordering Data

	Type	Order No.
Expander series module 256 input/output, incl. users manual	IBC EU	27 85 38 1
Digital input expander 24 V DC	IBC 24 EDI 1	27 85 36 5
Digital output expander 24 V DC	IBC 24 EDO 1	27 85 37 8
Power-Interface Digital input/output expander	IBC EDIO	27 85 49 1
Analog input/output Interface expander	IBC EAIO	27 85 50 1
Additional users manual for IBC EU	IBC UEU	27 85 71 8

Technical Specifications

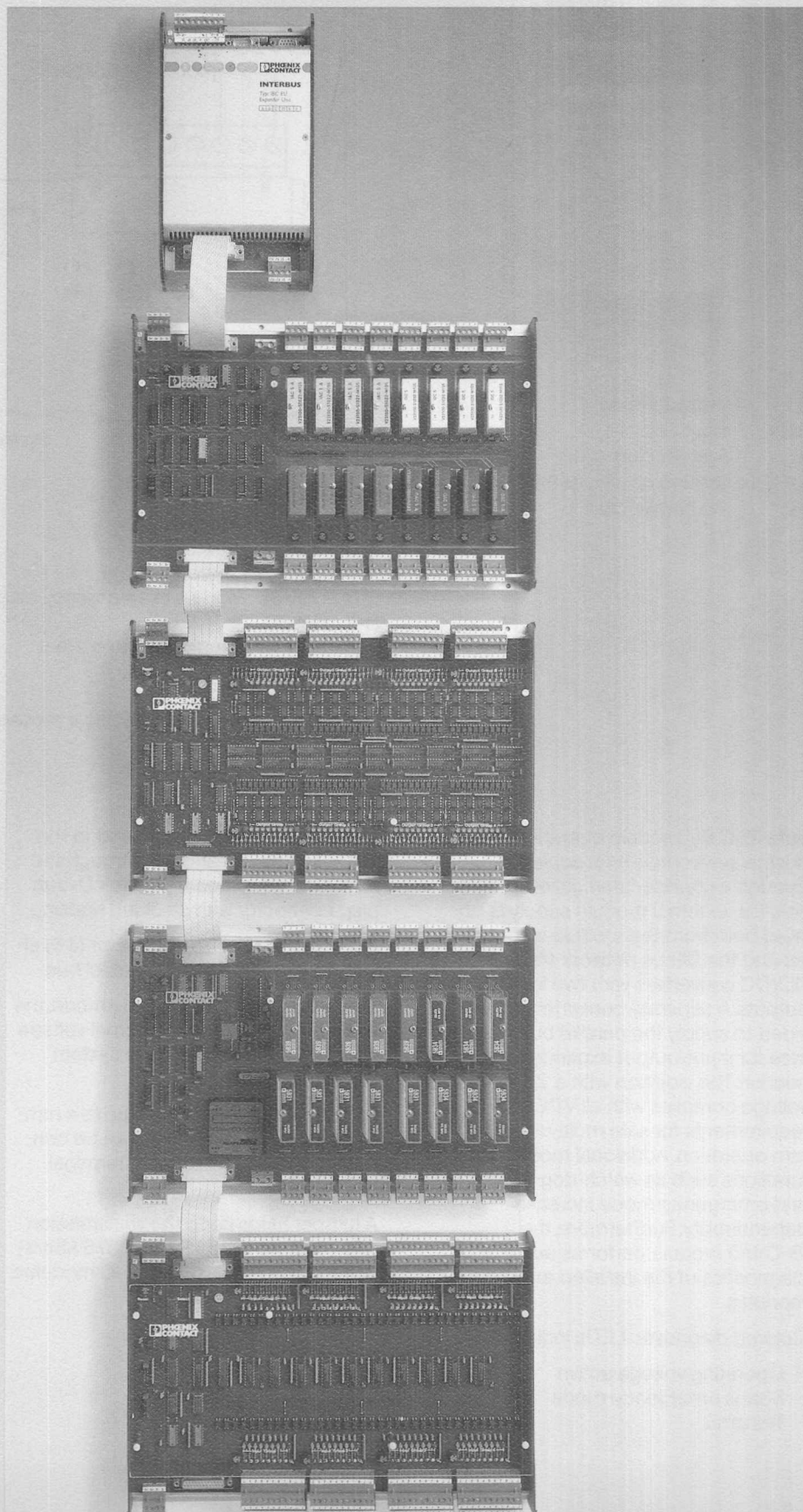
	IBC EU
Supply voltage U_p	24 V DC $\pm$ 10%
Current consumption	1.1 A
Number of inputs/outputs which can be connected	256
Type of connection	Parallel bus with differential signals
Length of parallel bus	4 m
Galvanic isolation Bus/Periphery	2.5 kV
Diagnostics Parallel bus and output monitoring	LED
Housing dimensions (DxWxH) in mm	245x129x66

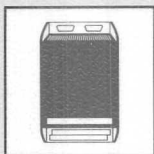


MODULES

I/O-Expander Module

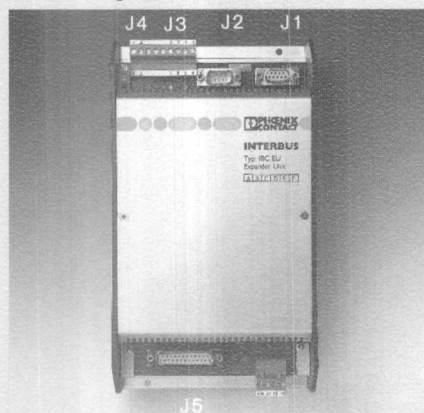
A high-electrical security standard of the INTERBUS-C expander modules along with a user-oriented firmware concept allows a wide technical and economic leeway when implementing the components into distributed Bitbus networks. In addition to the Intel DCX 51 real-time operating system, the firmware of the expander module contains the RAC task 0 with all standard Bitbus commands. Beyond it, a user-oriented extension of this basic command set ensures easy handling of up to 256 I/O points of the expander module group. Complete Bitbus compatibility and a RAM memory location with large storage capacity additionally allow the implementation of user-oriented application tasks on the expander module. The possibility of utilizing the module's intelligence for data preprocessing functions does not only offload the master of the complete Bitbus network but further enhances the response-time behavior for complex control and regulating processes.



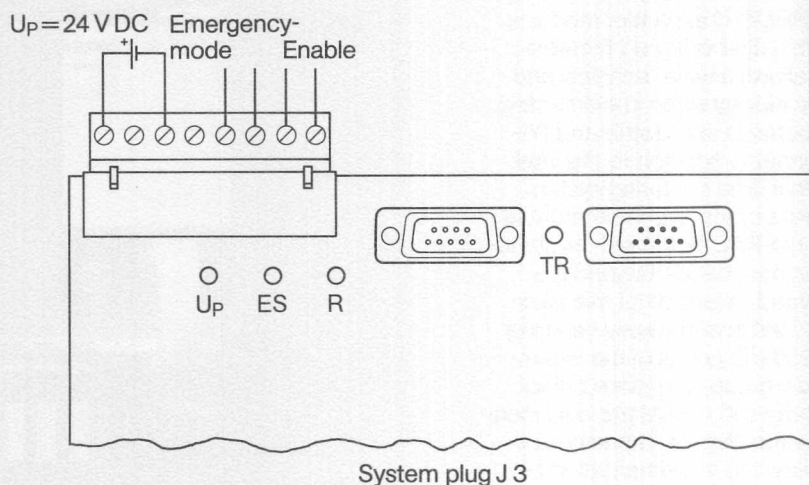


MODULES

I/O-Expander Module



- J 1 Output Bitbus
- J 2 Input Bitbus
- J 3 System plug
- J 4 Grounding wire connection
- J 5 I/O parallel bus



- U_P = Module supply voltage
- ES = Emergency-stop
 - LED on: Operating state
 - LED off: Module in emergency-stop
- R = Reset
 - LED on: Supply voltage correct
 - LED off: Module reset
- TR = Transmit
 - LED on: Module transmits a message

Safe IB-C EU module operation in industrial environments is achieved through a sophisticated galvanic isolation. The external module supply is isolated both from the module electronics and the Bitbus network through DC/DC converters with two isolated outputs. A separate converter is provided to supply the parallel bus-interface for input/output expander connection. The isolation with a 2.5 kV test voltage complies with all VDE and IEC requirements for safe multi-user system operation. Additional monitoring functions such as watch-dog-timer and emergency-mode increase dependability. Furthermore, the IB-C-I/O module performs automatic diagnostics of the installed expander modules.

Colored diagnostic LEDs indicate:

- Operating voltage active
- Status emergency-mode
- Transmit

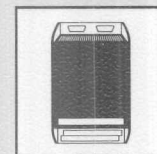
The Bitbus cable is connected to the I/O modules (J 1 and J 2) through the Intel recommended 9 position D-Sub plug connector with shielded housing.

A 25 position D-Sub connector (J 5) allows to connect the I/O parallel bus.

The wiring of the emergency-mode, the enable output and the external voltage supply is made through the system plug (J 3).

An external grounding wire up to 4 mm² connection cross section can be connected through a separate terminal block.

A jumper helps code the transmission rate required (62.5 kBit/s or 375 kBit/s) in the individual INTERBUS-C modules.



MODULES

Command List IBC EU

Additional Phoenix Commands

Switch Definition

- Allows to define inputs as dynamic switches to acquire short pulses

Input/Output Definition

- Allows to invert the input/output data of all inputs/outputs

Read Analog Channels

- Allows to read the data of a group of analog channels

Write Analog Channels

- Allows the user to write data to an analog channel group

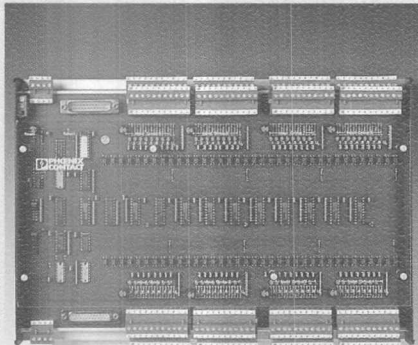
The IBC I/O module firmware contains the Intel DCX 51 real-time operating system including the RAC task 0. This task provides all existing commands for the communication with the installed I/O modules. A communication task extension allows to access max. 256 inputs/outputs, as if they were available on the module. Additional communication commands for handling the parallel bus connecting the I/O expander modules are not required. Thus, all inputs/outputs are operated with the existing Bitbus software and can be used by various master systems.

The IBC I/O module uses the Intel 8044 as a processor. Independent Bitbus communication processing and the real-time operating system are the basis for implementing user programs on the module. Sub-routines offload the host and improve network response time behavior for time critical applications.



MODULES

Expansion Unit Digital Input



Using the IBC 24 EDI 1 expansion unit up to 64 digital input data can be acquired and then transmitted to the host via the Bitbus network. This compact module is installed in the direct vicinity of the Bitbus expander module. Coupling is effected through one of the differential parallel buses covering a length of up to 4 m.

The 64 inputs – isolated in groups of 8 inputs – are directly 2-wire connected. Three-wire initiators can directly be connected to 32 inputs without having to use marshalling distributors for “+” and “-” voltages. This compact architecture reduces intermediate terminal points; documentation and service are simplified.

The external input supply voltage and the module operating voltage amount to 24 V DC. LEDs indicate the signal status of the individual inputs and the applied operating/supply voltage.

For individual input labeling the modules feature large marking fields.

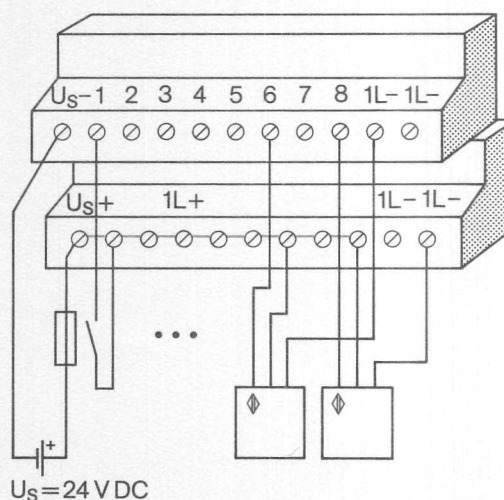
Technical Specifications

Operating voltage U_S	24 V DC
Supply voltage U_P	5 V DC from IBC EU
Number of inputs	64
Galvanic isolation	
– Parallel bus/Periphery	Yes
– Inputs	In groups of 8
Input voltage	
– Rated value	24 V DC
– Permissible range for “0” signal	–3 to +5 V
– Permissible range for “1” signal	13–30 V
Input current per channel	13 mA
Delay time “0” → “1”	3 ms
Delay time “1” → “0”	3 ms

Inputs: Initiators	
Number of initiator inputs	32 (3-wire)
Galvanic isolation	
– Parallel bus/Periphery	Yes
– Inputs	In groups of 8
Output voltage for initiators	24 V DC
Short circuit protection	Fuse 1.5 A

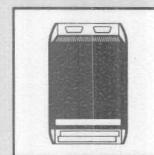
Diagnostics	
– Operating voltage indicator per group	LED green
– Status indicator per input	LED yellow
– Error display	LED red

Housing dimensions (D x W x H) in mm	245 x 359 x 66
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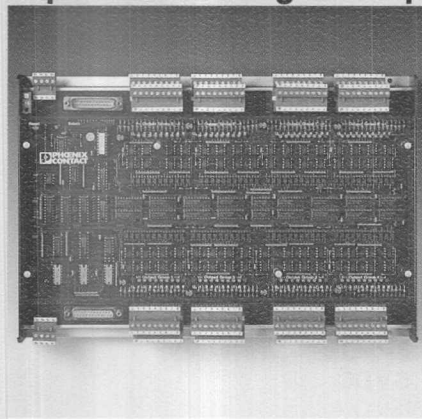
IBC 24 EDI 1 Input group

— Internal connection



MODULES

Expansion Unit Digital Output



The digital IBC 24 EDO 1 output module allows up to 64 actuators to be directly actuated through short-circuit proof semiconductor outputs. The module is installed in close proximity of the expander module. Connection is effected using an up to 4 m long parallel bus with differential signals.

All 64 outputs – isolated in groups of 8 – are directly 2-wire connected. A marshalling distributor for the grounding wire is not required, thus simplifying service and documentation. Signal line connection is effected via the easy-to-service plug-in COMBICON screw terminal blocks. The fixed wiring allows to replace the module without undoing the wiring.

For optical diagnostics function and status LEDs indicate the instantaneous operating state of the module.

For output labeling large marking fields are provided.

Technical Specifications

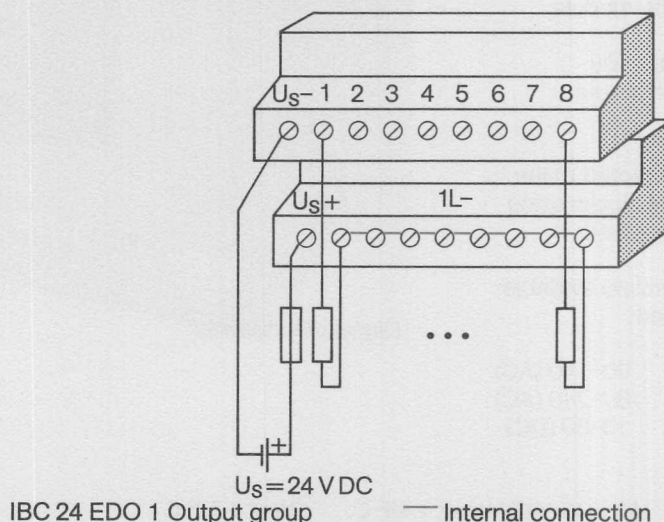
IBC 24 EDO 1

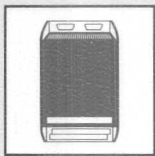
Operating voltage U_S	24 V DC $\pm 10\%$
Supply voltage U_P	5 V DC from IBC EU
Number of outputs	64
Galvanic isolation	
– Parallel bus/Periphery	Yes
– Outputs	In groups of 8
Output voltage	24 V DC
Output current	
– Rated value	500 mA
– Parallel operation	500 mA
Limitation of voltage induced on circuit interruption	Acc. to VDI 3422
Total load capacity per module	
– at 20° C	4 A
– at 55° C	See derating curve
Short-circuit protection	Electronic
Polarity protection of operating voltage	Fuse 5 A
Signal level of outputs at rated current	$U_S - 1.7 V$

Diagnostics

– Status indicator per output	LED yellow
– Operating voltage indicator	LED green
– Short-circuit/overload indicator of outputs	LED red

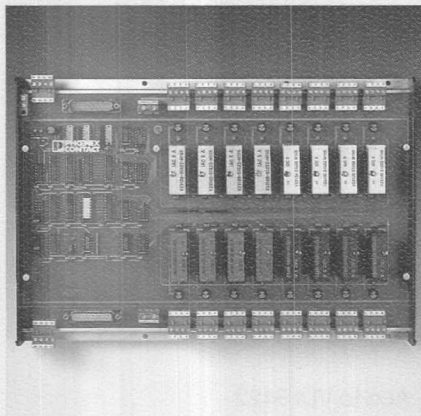
Housing dimensions (D x W x H) in mm	245 x 359 x 66
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MODULES

Power-Interface for 16 Digital Input/Output Modules



Power-interface offering freely selectable configurations for up to 16 standard I/O modules

This INTERBUS expander module offers optional configuration and is installed in the direct vicinity of the Bitbus expander module. Interconnection is made through an up to 4 m long local bus.

The INTERBUS IBC-EDIO module provides 16 freely configurable I/O slots for commercially available I/O modules¹⁾. For the Bitbus the 16 I/O address ports are subdivided into two 8-bit ports. Both the signal status of the individual I/O modules and the operating voltage or an interference are LED-indicated on the module.

The 16 slots can be optionally equipped with input and output modules.

The signal lines are connected to the Phoenix-MKDS-terminal blocks using the 2-wire connection method.

¹⁾ The following commercially available I/O modules can be used:

Inputs

IAC5	AC-Input	90-140 (AC)
IAC5A	AC-Input	180-240 (AC)
IDC5	DC-Input	10-30 (DC)

Outputs

DAC5	AC-Output	12-140 (AC)	3A at +45° C	2A at +70° C
DAC5A	AC-Output	24-200 (AC)	3A	2A
ODC6	DC-Output	60 (DC)	3A	2A

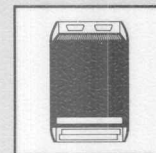
Technical Specifications

IBC EDIO

Operating voltage U_S	24 V DC $\pm$ 10%
Supply voltage U_P	24 V DC $\pm$ 10%
Number of inputs/outputs	16
Galvanic isolation	4 kV opto-isolation in the I/O modules
- Parallel bus/Periphery	Yes
- Inputs	
Input/Output voltage	5-240 V (AC/DC)
- at the periphery	5 V DC
- at the module	
Diagnostics	
- Operating voltage indicator	LED green
- Status indicator per input/output	LED yellow
- Error indicator	LED red
Housing dimensions (DxWxH) in mm	245x359x66

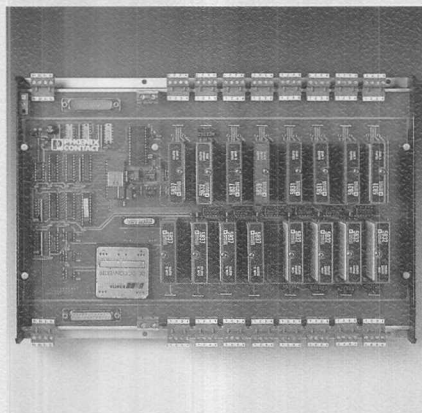


Digital I/O modules



MODULES

Analog Input/Output Interface for 16 Standard Analog Modules



Analog input/output modules with optional configuration for the Analog Devices Corporation's 5 B Series.

Due to their compact and modular housing design modules of the Analog Devices Corporation's 5 B Series are increasingly used for signal conditioning and analog signal isolation in industrial automation.

The INTERBUS IBC-EAIO module allows to connect up to 16 analog signals to the Bitbus network using the 5 B Series from Analog Devices Corporation. For this, the INTERBUS module offers 16 sockets for the analog interface modules which may be optionally equipped using any configuration depending on the process signal. The modules of the 5 B Series provide analog signal conditioning and galvanic isolation in one unit. For safe operation in industrial environments they feature an input surge protection and a 1,5 kV isolation. The modules are designed for direct connection of all standardized low-level and high-level analog signals, such as:

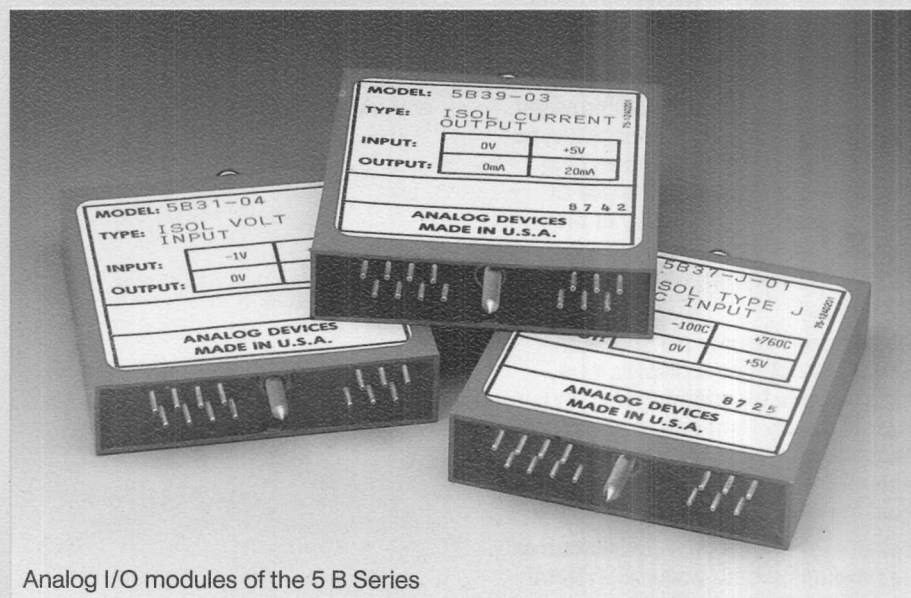
- 0 to 5 VDC,
- ± 10 VDC,
- 0 to 20 mA,
- 4 to 20 mA,
- PT 100 temperature sensor.

Analog signal conversion and conditioning automatically happens in the analog I/O modules which provide the IBC-EAIO expansion unit with a standardized analog value. A 12-bit AD/DA converter performs conversion on the board.

All analog inputs/outputs are isolated among themselves and from the parallel bus.

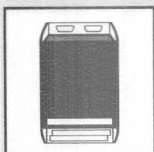
Technical Specifications

Operating voltage U_S	24 V DC $\pm 10\%$
Supply voltage U_P	24 V DC $\pm 10\%$
Number of analog inputs/outputs	16 sockets for commercially available analog I/O modules
Galvanic isolation	
- Parallel bus/Periphery	Yes
- Inputs	Yes
Connection method of sensors	2-wire
Measuring value representation	12 bit binary
Measuring principle	Free-running conversion with successive approximation
Conversion time	25 μ s
Noise suppression	75 dB min.
Linearity	$\pm 1/2$ LSB
Housing dimensions (DxWxH) in mm	245x359x66



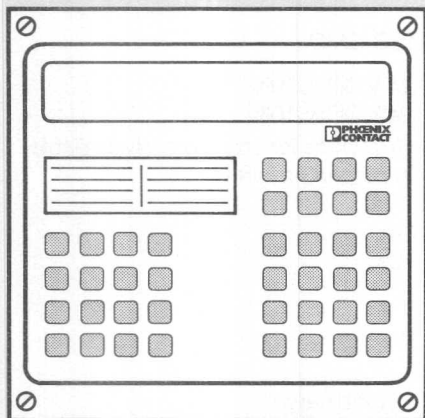
Analog I/O modules of the 5 B Series

For optical diagnostics function and error LEDs are provided indicating the module's instantaneous operating status.



MODULES

Production Data Acquisition Terminal Unit



Production Data Acquisition Terminal Unit

The INTERBUS-C IBC-BDE 01 production data acquisition terminal unit is an intelligent freely programmable Bitbus module. The use of the reliable 8044 microcontroller ensures a wide range of function variants, such as access to predefined RAC-task function units and down-load of user tasks for control functions which refer to the application. Easy and fast connection to the Bitbus as well as user-oriented standard software tool handling decisively optimize system application.

Due to its design the IBC BDE 01 production data acquisition terminal unit can be used for production machine control and automation as well as for the acquisition of the most important production data. The terminal provides convenient host access capabilities as well as direct terminal programming by "down-load" including the use of the local intelligence directly at the machine "on site". Thus, the user has available versatile application capabilities.

The terminal features a 4-line, illuminated LCD dot matrix display, thus being suitable for optimum text and graphic display. Parameters and commands are keyed in using the conveniently designed, dust-and water-proof foil keyboard.

Typical examples for the application of the production data acquisition terminal unit can be found during

- data acquisition at production machines
- differential regulation
- flow and dosing control
- monoaxial positioning control
- machine monitoring

Ordering Data

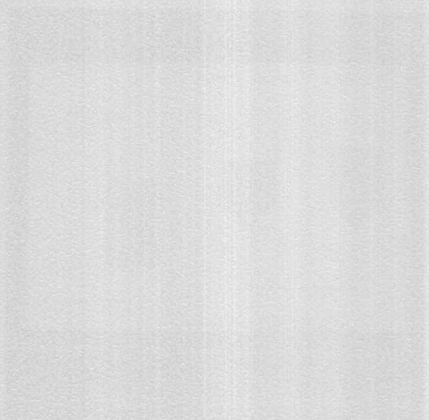
	Type	Order No.
Operating data acquisition terminal incl. users manual	IBC BDE 01	On request
Additional users manual for IBC-BDE 01	IBC UBDE 01	On request

Technical Specifications

	IBC BDE 01
Operating voltage U_s	220 V AC
Serial interfaces	INTERBUS-C/Bitbus V.24/RS-232-C
Digital inputs	On request
Digital outputs	On request
Analog I/O	On request
Display	LCD dot matrix
Keyboard	Dust and water-proof foil keyboard

An intelligent on site control device is thus available which is connected to standardized industrial field bus systems through standardized interfaces, such as the Intel Bitbus interface and a V.24 (RS-232-C) interface.

THE HISTORY OF THE



The book is a history of the...

The author, [Name], is a leading expert on the subject. The book is written in a clear and concise style, making it accessible to a wide range of readers. It covers the history of the subject from its origins to the present day, and includes a detailed bibliography.

The book is a valuable addition to the literature on the subject. It is well written and easy to read, and it provides a comprehensive overview of the history of the subject. It is a must-read for anyone interested in the subject.

The book is a well-written and informative history of the subject. It covers the history of the subject from its origins to the present day, and includes a detailed bibliography. The author, [Name], is a leading expert on the subject.

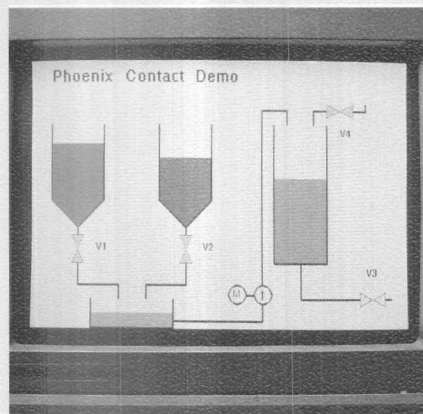
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SOFTWARE

Process Visualization Using the IB-C Etools VIS 01



IB-C Etools VIS 01 Process Visualization System

The IB-C Etools VIS 01 process visualization system allows for straightforward and clear display image of sophisticated process sequences on all IBM PCs which use the MS DOS operating system by evaluating the production data acquired via the INTERBUS-C.

An easy-to-use and future-oriented process visualization must meet the following requirements to enable the user to create and maintain its own application related process images without requiring considerable training:

- Easy and interactive process image creation on the screen.
- Short generation and correction time.
- Possibility of adapting process images to the most different system conditions.
- Easy to change elements from self-created libraries.
- Direct and easy connection to standardized bus systems like the INTERBUS-C.

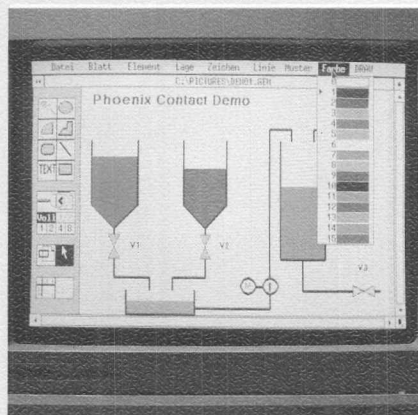
The IB-C Etools VIS 01 process visualization system is a low-cost software package operating under GEM – Graphics Environment Manager – from Digital Research. In addition to a convenient user interface the system also offers a simple CAD program – GEM Draw Plus – which is used to plot the graphics. The integrated interface to the standardized high-languages allows for graphic data output and display of the process data acquired by INTERBUS-C on screens, printers, plotters etc.

Ordering Data

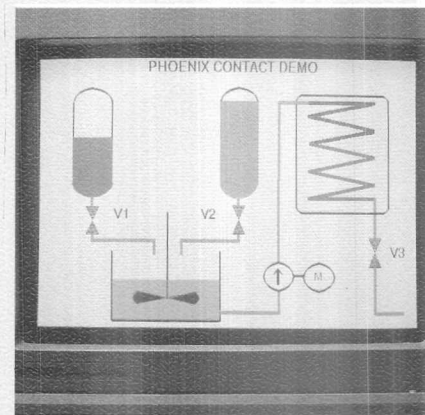
	Type	Order No.
Process visualization system Etools-VIS 01 with assignment editor for DOS operating system incl. users manual – On 5 1/4"-floppy disk	IBC VIS 015	On request
– On 3 1/2"-floppy disk	IBC VIS 013	On request
– On 5 1/4"-floppy disk with software license for 25 copies for DOS	IBC VIS 015 L	On request
– On 3 1/2"-floppy disk with software license for 25 copies for DOS	IBC VIS 013 L	On request
Additional users manual for IBC Etools VIS 01	IBC UVIS 01	On request

The design of a process image is made in three steps which can be repeated until the desired result is achieved.

1. By using GEM Draw Plus a process diagram is plotted that contains all static objects as well as those variable during operation.



2. The assignment editor, part of the Etools VIS 01 system, helps operate all image elements due to be variable. Features like text, color, degree of filling etc. are assigned to them. Communication to the INTERBUS-C is made using simple commands.

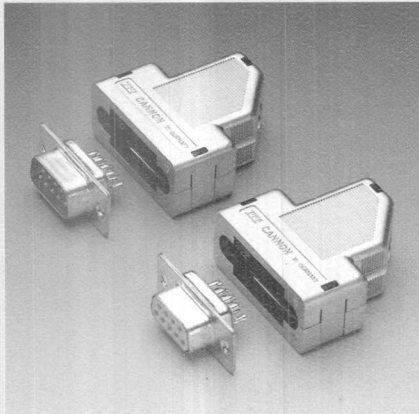


3. Then the process image is checked during operation or using a simulation model.



ACCESSORIES

Plug Connector with Solder Connection

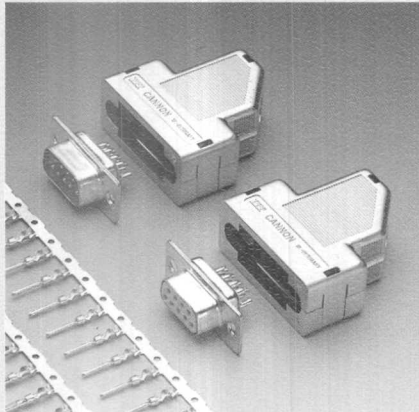


Ordering Data

	Type	Order No.
9 position D-Sub plug connector with solder connection (packed in pairs)	IBC DSUB/L	27 85 19 0

For Bitbus cable connection to the I/O module. D-Sub plug connector design with solder connection.

Plug Connector with Crimp Snap-in Connection

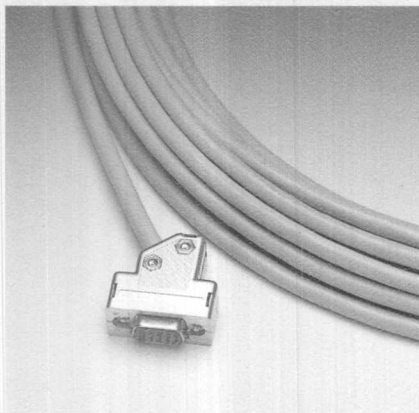


Ordering Data

	Type	Order No.
9-position D-Sub plug connector with crimp snap-in connection (packed in pairs)	IBC DSUB/C	27 85 20 0

For Bitbus cable connection to the I/O module. D-Sub plug connector design with crimp snap-in connection.

Bitbus Cable

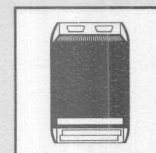


Ordering Data

	Type	Order No.
Bitbus cable*) without D-Sub plug connector	IBC BC Meter	27 85 09 3
Bitbus cable*) with prefinished D-Sub plug connectors (cable screen mounted single-sided)	IBC DSUB/L-finished	27 85 31 0

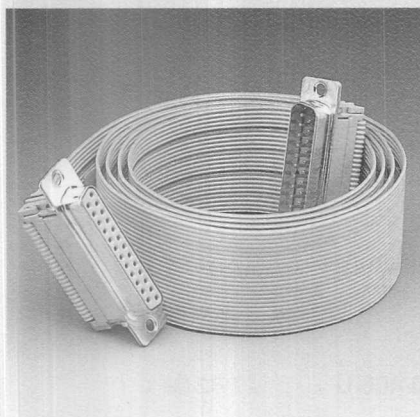
The Bitbus cable LI-YCY 3x2x0.2 mm² with a max. cable capacity of 120 pF/m interconnects the I/O modules.

*) State length when ordering



ACCESSORIES

Prefinished Parallel Bus Cable

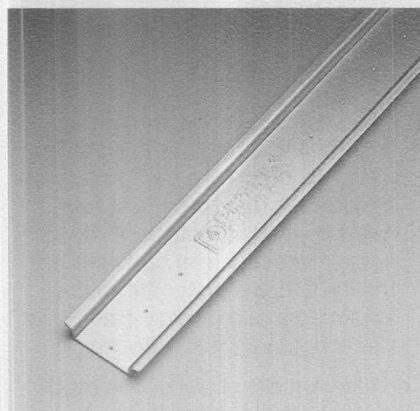


Ordering Data

	Type	Order No.
Prefinished parallel bus cable for the I/O expander, 100 cm – Flat cable	IBC EUC 100	27 85 43 3

The expander I/O modules are interconnected using prefinished parallel bus cables.

Mounting Rail

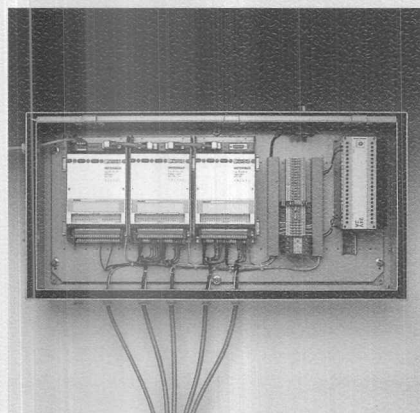


Ordering Data

	Type	Order No.
Mounting rail, steel, yellow chromated, unperforated, 2 m	MS 35/7.5 unperforated	08 01 68 1
Fitting tool for mounting rail installation	IBS MS	On request

The INTERBUS modules snap onto two NS 35/7.5 mounting rails acc. to EN 50022.

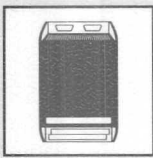
Prefinished Module Station



Ordering Data

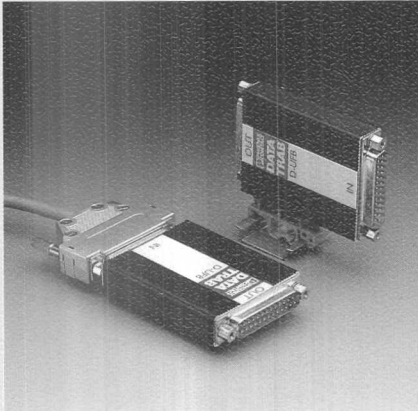
	Type	Order No.
Prefinished module station consisting of – I/O modules – Power supply		On request

Already completely prefinished terminal boxes are supplied to ensure a fast distributed installation of INTERBUS-C modules. One module station is basically equipped with the I/O modules and the power supply. Number and type of the I/O modules correspond to individual demand.



ACCESSORIES

Surge Protection for Bitbus Cables



Ordering Data

	Type	Order No.
Surge protection module Fine protection Rail mountable	D-UFB-485/S-U	27 82 61 4
Surge protection module Fine protection Without snap-in mounting foot	D-UFB-485/S	27 82 62 7
Surge protection module Fine and coarse protection Rail-mountable	D-UFB-485-U	27 82 59 1
Surge protection module Fine and coarse protection Without snap-in mounting foot	D-UFB-485	27 82 60 1
Ground terminal block for cross sections up to 4 mm ²	USLKG 4	04 41 01 2

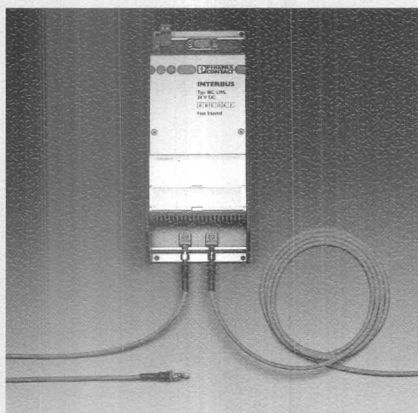
To protect serial signal transmission from transient surge voltages caused by lightning strikes or from high-frequency noise voltage pulses, INTERBUS provides four surge protection elements which differ in housing design and logic.

1. For bus cable in-house installations the surge protection modules **D-UFB-485/S-U** or **D-UFB-485/S** should be used depending on the installation facilities. These surge protection modules filter high-frequency noise voltage pulses with low energy content out of the signal line.

2. The surge protection modules **D-UFB-485 U** and **D-UFB-485** featuring an integrated gas filled surge arrestor are used when the bus cable is installed outdoors. The surge protection elements protect the INTERBUS system from destruction caused by high-energy transients e.g. by lightning discharge.

The different surge protection modules are available with or without snap-in mounting foot depending on the installation required.

Beam Wave Guide Module



Ordering Data

	Type	Order No.
Beam wave adapter module	IBC LWL	On request

The INTERBUS-C beam wave guide modules guarantee safe signal transmission also in industrial environments which are prone to electromagnetic interferences.

The loop-configured transmission path simultaneously offers optimized galvanic isolation of various INTERBUS-C segments.



1. The first part of the report is an introduction to the project. It should state the purpose of the study, the objectives, and the scope of the work. It should also mention the date of the report and the name of the person who prepared it.	2. The second part of the report is a description of the methods used in the study. This should include a description of the subjects, the materials, and the procedures used. It should also mention the date of the study and the name of the person who conducted it.
3. The third part of the report is a description of the results of the study. This should include a description of the data collected, the analysis of the data, and the conclusions drawn from the data. It should also mention the date of the study and the name of the person who conducted it.	4. The fourth part of the report is a discussion of the results of the study. This should include a discussion of the implications of the results, the limitations of the study, and the suggestions for further research. It should also mention the date of the study and the name of the person who conducted it.
5. The fifth part of the report is a conclusion. This should summarize the main findings of the study and state the overall conclusion. It should also mention the date of the study and the name of the person who conducted it.	6. The sixth part of the report is a bibliography. This should list all the sources used in the study, including books, articles, and other documents. It should also mention the date of the study and the name of the person who conducted it.
7. The seventh part of the report is an appendix. This should contain any additional information that is relevant to the study, such as raw data, calculations, and other documents. It should also mention the date of the study and the name of the person who conducted it.	8. The eighth part of the report is a list of references. This should list all the sources used in the study, including books, articles, and other documents. It should also mention the date of the study and the name of the person who conducted it.
9. The ninth part of the report is a list of figures. This should list all the figures used in the study, including graphs, tables, and other visual aids. It should also mention the date of the study and the name of the person who conducted it.	10. The tenth part of the report is a list of tables. This should list all the tables used in the study, including data tables, summary tables, and other tables. It should also mention the date of the study and the name of the person who conducted it.
11. The eleventh part of the report is a list of equations. This should list all the equations used in the study, including mathematical formulas, chemical equations, and other equations. It should also mention the date of the study and the name of the person who conducted it.	12. The twelfth part of the report is a list of definitions. This should list all the definitions used in the study, including technical terms, abbreviations, and other definitions. It should also mention the date of the study and the name of the person who conducted it.
13. The thirteenth part of the report is a list of acknowledgments. This should list all the people and organizations that helped in the study, including the sponsor, the supervisor, and other people. It should also mention the date of the study and the name of the person who conducted it.	14. The fourteenth part of the report is a list of appendices. This should list all the appendices used in the study, including raw data, calculations, and other documents. It should also mention the date of the study and the name of the person who conducted it.
15. The fifteenth part of the report is a list of references. This should list all the sources used in the study, including books, articles, and other documents. It should also mention the date of the study and the name of the person who conducted it.	16. The sixteenth part of the report is a list of figures. This should list all the figures used in the study, including graphs, tables, and other visual aids. It should also mention the date of the study and the name of the person who conducted it.
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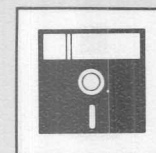
PROGRAMMING

List of the INTEL-RAC Commands

The Intel DCX 51 real-time operating system is included in the firmware of all INTERBUS modules with the exception of the IBC 24 DIO/C module. In this manner the modules support

the Intel Remote Access Control (RAC) command set and are software compatible to existing Bitbus systems. The IBC 24 DIO-C module contains a subset of the Intel RAC commands.

Command	Function
Reset Slave	Reset the 8044 firmware
Create Task	Create a new iDCX 51 task
Delete Task	Delete an existing iDCX 51 task
Get Function ID	Get the function Id table
RAC Protect	Disable/enable access commands
Read I/O	Read the specified I/O ports
Write I/O	Write to the specified I/O ports
Update I/O	Write/read the specified I/O ports
Upload Memory	Read the specified data memory
Download Memory	Write to the specified data memory
OR I/O AND I/O XOR I/O	OR values into specified I/O ports AND values into specified I/O ports XOR values into specified I/O ports
Write Internal Memory	Write to the specified internal memory
Read Internal Memory	Read the specified internal memory
Node Info	Return device-related information
Upload Code	Read the specified code memory
Download Code	Write the specified code memory into EEPROM



PROGRAMMING

Additional Commands

Additional commands are implemented in the INTERBUS module firmware in order to supplement the Intel RAC

commands as well as to utilize the module's intelligence. These commands are structured so as to fit into the standard

Intel concept and to be able to use them with the existing software of different master systems without any difficulties.

Command	Function
Single Shot/ Retriggerable Single Shot Definition	Allows the master to define single shots. The number of outputs definable as single shots depends on the module type. When triggering the single shot function, a pulse of a defined length is generated at the output
Clock Definition	Allows to configure digital outputs as clock generator at variable clock frequencies. The number of the definable clock generators depends on the type of module
Output Definition/Input Definition	Output/input data is automatically inverted after activating this command
Debounce Time	Allows to preset the debounce time for an input port
On-/Off-Delay Output	This definition allows to specify an on-/off-delay for output signals. An output only switches on/off after receiving the off command, when a defined time elapsed
Counter Definition	Allows to define digital inputs as counters
Switch Definition	Allows to define inputs as dynamic switches to acquire short pulses
Read Counter with Set	Allows to read a defined counter and set it to a preset value The counter starts with this value and counts upward
Read Counter	Allows to read out a defined counter without clearing it
Read Analog Channels	Allows to read the data of an analog channel group
Write Analog Channels	Allows to write the data to an analog channel group
Read Analog Channels with Gain	Allows to read the data and the gain of an analog channel group
Read Analog Channels Average	Allows to read average of an analog channel of a group
Write Parameter for Channel Gain	Allows to modify the preset gain
Write Analog Channels	Allows the user to write data to an analog channel group
Read Channel A	Allows to read data out of the FIFO memory of the V.24 (RS-232-C) interface A
Write Channel A	Allows write data into the FIFO memory of the V.24 (RS-232-C) interface A
Read DSR Channel A	Allows to read the signal DATA SET READY
Configure Channel A	Allows to modify the preset values of the serial interface. Transmits parameters for the baud rate, parity, character length and number of stop bits
Emergency-mode Processing	Allows emergency-mode processing (release/enable)

Note: All commands applicable to the V.24 (RS-232-C) interface A can be applied to the V.24 (RS-232-C) interface B as well.



TECHNICAL SPECIFICATIONS

General Technical Specifications

Temperature range:	
– Operation	0° C to + 55° C (air inlet temperature) DIN 40040 class kV
– Storage/Transport	– 25° C to + 70° C
Humidity:	75% on average, 85% occasional, no condensation, DIN 40040 class F
Air pressure (operation):	860 to 1060 hPa, 1500 m
Class of protection:	Class 1 VDE 0106, IEC 536
Degree of protection:	IP 20 DIN 40050, IEC 529
Insulation distances:	Acc. to VDE 0160 (IEC 664)
Mounting rail:	Acc. to EN 50022
Preferred mounting arrangement:	Panel, vertical

Emergency-Mode Input

Number of inputs	1
Galvanic isolation	
– Bus/Periphery	Yes
Input voltage	24 V DC
Input current	13 mA

Enable Output

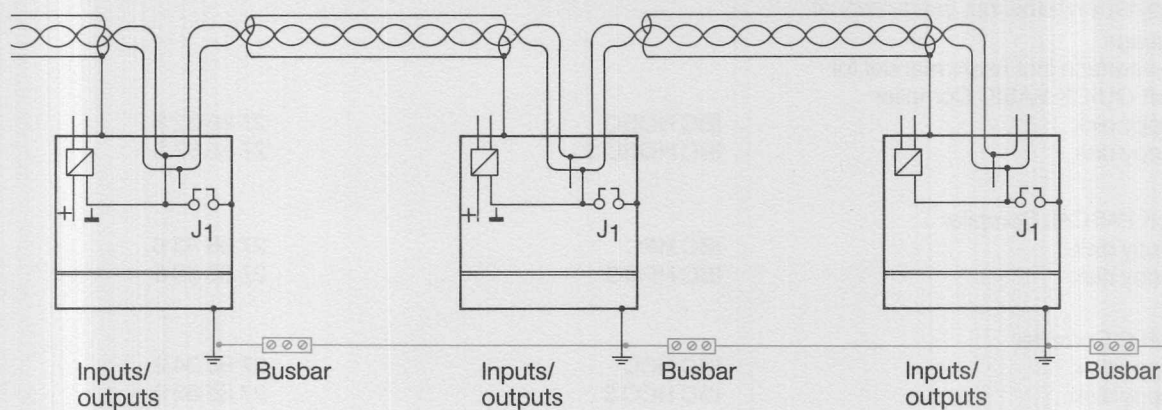
Number of outputs	1 relay contact
Max. switching voltage	100 V AC/DC
Max. switching current	500 mA
Max. switching capacity	10 VA

Note:

We reserve all rights for any type of modifications furthering technical progress.

GALVANIC ISOLATION

Floating/Non-floating Architecture



Floating Architecture

In widely spread systems a floating installation is preferred due to different actuator and sensor reference potentials against ground.

INTERBUS-C also here provides the liberties required for industrial installations. For this reason the connection of the internal ground to the housing is designed as a removable jumper. With the jumper open, an equi-potential bonding line between the individual modules is not necessary, as potential differences up to 60 V AC are allowed.

The signal lines of the I/O modules are additionally opto-isolated from the bus cables. Thus, module stations can be installed with the signal lines of the actuators and sensors at different potential levels.

Note:

For floating system architecture the occurrence of shock-hazardous voltages against ground has to be prevented. This can be achieved by grounding installation sections or using insulation testers with voltage limitation.

Non-floating architecture

In systems requiring potential equalization the grounding busbars of the individual module stations should be interconnected via an equi-potential bonding line (at least 10 mm² copper wire). The internal module ground is applied to the module housing by installing the jumper J 1. The signal lines of the sensors and actuators may have different potential levels due to the optoelectronic isolation.



ORDERING DATA

Controller	Type	Order No.
Controller board for IBM computer systems, incl. users manual	IBC PC CON	27 85 08 0
High-language Software-Interface incl. users manual for – Microsoft QUICK-BASIC Compiler		
5 1/4"-floppy disk	IBC HQBC	27 85 32 3
3 1/2"-floppy disk	IBC HQBC 3	27 85 87 3
– Microsoft PASCAL Compiler		
5 1/4"-floppy disk	IBC HPC	27 85 33 6
3 1/2"-floppy disk	IBC HPC 3	27 85 88 6
– Microsoft C Compiler		
5 1/4"-floppy disk	IBC HCC	27 85 34 9
3 1/2"-floppy disk	IBC HCC 3	27 85 89 9
– Microsoft FORTRAN 77 Compiler		
5 1/4"-floppy disk	IBC HFC	27 85 35 2
3 1/2"-floppy disk	IBC HFC 3	27 85 90 9
– PLM 86		
5 1/4"-floppy disk	IBC HPLM	27 85 44 6
3 1/2"-floppy disk	IBC HPLM 3	27 85 91 2
– Borland Turbo Pascal		
5 1/4"-floppy disk	IBC HTP	27 85 92 5
3 1/2"-floppy disk	IBC HTP 3	27 85 93 8
V.24 (RS-232-C) Master Module incl. users manual	IBC V.24 M	On request

Modules	Type	Order No.
Digital Input/Output, configurable, 24 V DC, incl. users manual	IBC 24 DIO/C	27 85 02 2
Digital Input/Output, 24 V DC, incl. users manual	IBC 24 DIO	27 85 01 9

Modules	Type	Order No.
Analog Input, 0–10 V differential	IBC AI 1	27 85 10 3
± 10 V differential	IBC AI 2	27 85 15 8
0–10 V single ended	IBC AI 3	27 85 16 1
± 10 V single ended	IBC AI 4	27 85 17 4
0–20 mA	IBC AI 5	27 85 18 7
incl. users manual		
Analog Output, ± 10 V, 0–20 mA, incl. users manual	IBC AO 1	27 85 39 4
Analog Output, 0–10 V, 4–20 mA, incl. users manual	IBC AO 2	27 85 40 4



ORDERING DATA

Modules	Type	Order No.
Analog/Digital I/O, 0–10 V differential	IBC 24 ADIO 1	27 85 03 5
± 10 V differential	IBC 24 ADIO 2	27 85 11 6
0–10 V single ended	IBC 24 ADIO 3	27 85 12 9
± 10 V single ended	IBC 24 ADIO 4	27 85 13 2
0–20 mA incl. users manual	IBC 24 ADIO 5	27 85 14 5
Analog Output-Digital I/O, ± 10 V, 0–20 mA, incl. users manual	IBC 24 AO DIO 1	27 85 41 7
Analog Output-Digital I/O, 0–10 V, 4–20 mA, incl. users manual	IBC 24 AO DIO 2	27 85 42 0

Modules	Type	Order No.
Communication module, 2x V.24, incl. users manual	IBC V.24	27 85 07 7

Modules	Type	Order No.
Expander series module, 256 inputs/outputs, incl. users manual	IBC EU	27 85 38 1
Digital input expansion unit, 24 VDC	IBC 24 EDI 1	27 85 36 5
Digital output expansion unit, 24 VDC	IBC 24 EDO 1	27 85 37 8
Power-interface, Digital input/output expander	IBC EDIO	27 85 49 1
Analog input/output expander	IBC EAIO	27 85 50 1



ORDERING DATA

Modules	Type	Order No.
Operating data acquisition, incl. users manual	IBC BDE 01	On request
Process visualization system Etools VIS 01 with assignment editor for DOS operating system, incl. users manual – On 5¼" floppy disk	IBC VIS 015	On request
– On 3½" floppy disk	IBC VIS 013	On request
– 5¼" floppy disk with software license for 25 copies for DOS	IBC VIS 015 L	On request
– 3½" floppy disk with software license for 25 copies for DOS	IBC VIS 013 L	On request

Users Manuals for	Type	Order No.
Controller board	IBC UPC CON	27 85 63 7
V.24 (RS-232-C) Master module	IBC UV.24 M	On request
Digital input/output, configurable	IBC UDIO/C	27 85 64 0
Digital input/output	IBC UDIO	27 85 65 3
Analog input	IBC UAI	27 85 66 6
Analog output	IBC UAO	27 85 67 9
Analog/Digital I/O	IBC UADIO	27 85 68 2
Analog output – Digital I/O	IBC UAODIO	27 85 69 5
Communication module V.24 (RS-232-C)	IBC UV.24	27 85 70 5
Expander series module	IBC UEU	27 85 71 8
Operating data acquisition terminal	IBC UBDE 01	On request
Process visualization system Etools-VIS 01	IBC UVIS 01	On request

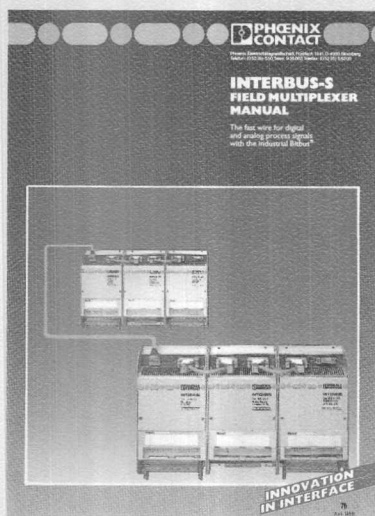
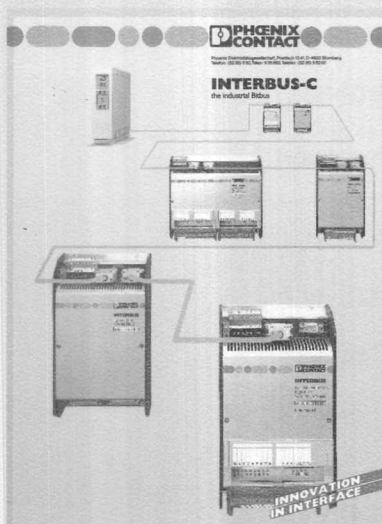
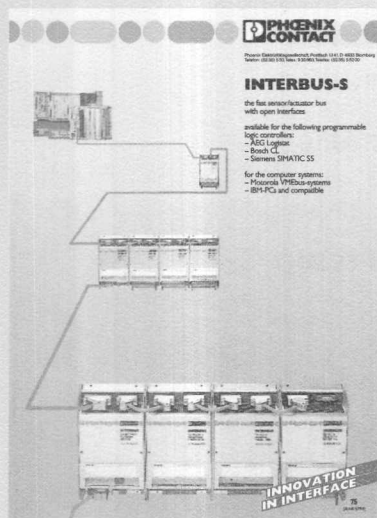


ORDERING DATA

Accessories	Type	Order No.
Bitbus cable (State length when ordering)	IBC BC Meter	27 85 09 3
9 position D-Sub connector with solder connection (packed in pairs)	IBC DSUB/L	27 85 19 0
9 position D-Sub connector with crimp snap-in connection (packed in pairs)	IBC DSUB/C	27 85 20 0
9 position D-Sub connector, finished (State length when ordering)	IBC DSUB/L- KONFEK.	27 85 31 0
Prefinished parallel bus cable for the I/O expansion unit, 100 cm	IBC EUC 100	27 85 43 3
Fitting tool for mounting rail installation	IBS MS	On request
Mounting rail, steel yellow-chromated, unperforated, length: 2 m	NS 35/7.5 unperforated	08 01 68 1
Prefinished module station		On request
Surge protection modules		
Fine protection Rail-mountable	D-UFB-485/S-U	27 82 61 4
Fine protection Without snap-in mounting	D-UFB-485/S	27 82 62 7
Fine and coarse protection Rail-mountable	D-UFB-485-U	27 82 59 1
Fine and coarse protection Without snap-in mounting foot	D-UFB-485	27 82 60 1
Ground terminal block for max. 4 mm ² cross section	USLKG 4	04 41 01 2
Brochure: IBC planning tool	IBC PT	27 85 96 7



SELECTOR GUIDE



INTERBUS-S

In automated control engineering INTERBUS-S, the real time distributed I/O data bus is used in connection with PLCs (e.g. Siemens, Bosch, AEG etc.), VMEbus systems or fast mini computers. The modular INTERBUS I/O modules are installed in the terminal boxes of the machine units and connected to the central unit through a serial remote bus. Up to 4096 data signals can be transmitted via this serial bus cable. System cycle time: 4 ms for 1000 inputs and 1000 outputs! INTERBUS-S reliably excludes any time problems within the data transmission link.

Remote controller boards for various control systems are available on request.

INTERBUS-C

For complex solutions in automation processes with computers and programmable controllers as well as with production/machine data acquisition systems, INTERBUS-C is employed as an open standardized field bus system based on the Intel Bitbus (RS 485). INTERBUS-C modules interoperate with devices supplied by other manufacturers through the Bitbus. All IB-C modules support the Intel RAC format.

In addition to standard I/O modules, modules with RS-232-C interface or special functions are offered. INTERBUS-C can be connected to every IBM-PC, -XT, -AT, and compatible computer systems. The INTERBUS-C modules are supported by original DEC software (DECscan) for VAX computers as well as directly by Intel Multibus and Siemens SMP as well as VMEbus systems.

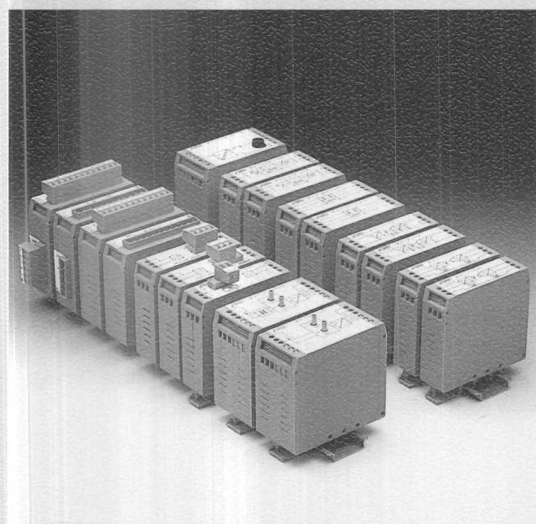
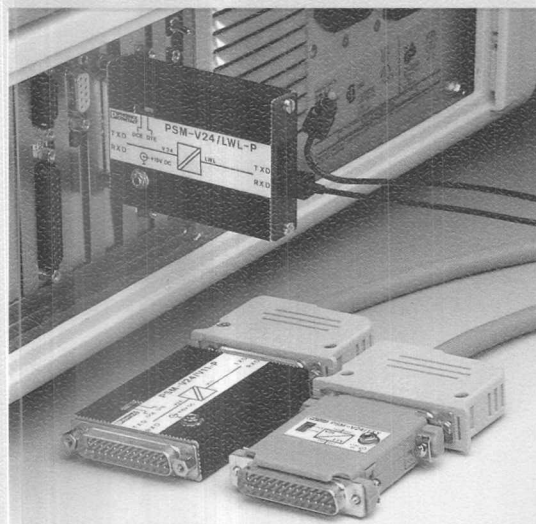
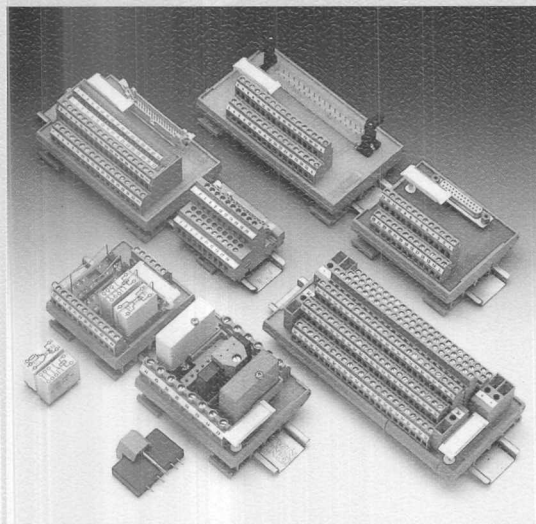
INTERBUS-S/Field Multiplexer

The INTERBUS-S Field Multiplexer is used as a wire saving connection between remote installation parts. Wiring of sensors and actuators in the individual stations is made through parallel wires to the I/O modules. Signal transmission up to a distance of 1200 m between the installation parts is made serially via 4 wires. Up to 336 digital/analog signals are transmitted in each direction. The Field Multiplexer uses the Bitbus as well.

The INTERBUS-S Field Multiplexer simplifies wiring and provides sufficient cable capacity.



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Modular Interface-Modules

Apart from INTERBUS, Phoenix offers a wide range of modular interface solutions.

VARIOFACE

A VARIOFACE module is required when signal lines of up to 2.5 mm² cross section are to be connected to highposition electronic plug connectors such as D-Sub, flat cable or DIN headers.

VARIOFACE modules connect a wide range of multi-position computer inputs/outputs to standard signal lines of sensors and actuators. Apart from pure cross section adaption VARIOFACE offers the integration of special logic functions. VARIOFACE modules are designed as active modules for signal adaption and signal amplification as well as for custom-related solutions to solve individual interface problems between computer, programmable controller and field devices. The multi-function interface modules are documented in a special VARIOFACE brochure available on request.

Interface-Converters

The increasing distribution of computer systems and the EDP-periphery affiliated to them simultaneously involve an increase in the variety of equipment interface types.

To be able, in practise, to transmit e.g. data from an IEEE-controller to a V.24/RS-232-C printer or to realize for serial data transmission systems a connection between RS-422 terminals to RS-232-C/V.24 modems, Phoenix offers converter modules of the most different housing sizes within its VARIOFACE range.

Here a short overview of the interface-converters available:

- RS-232-C/V.24-RS-422
- RS-232-C/V.24-RS-485
- RS-232-C/V.24-TTY 20 mA (current loop)
- RS-232-C/V.24-RS-488

In future, the new Phoenix interface converter modules will also allow to link subscribers with differently standardized interfaces to the joint network structures.

Modular Analog Interface Modules MCR

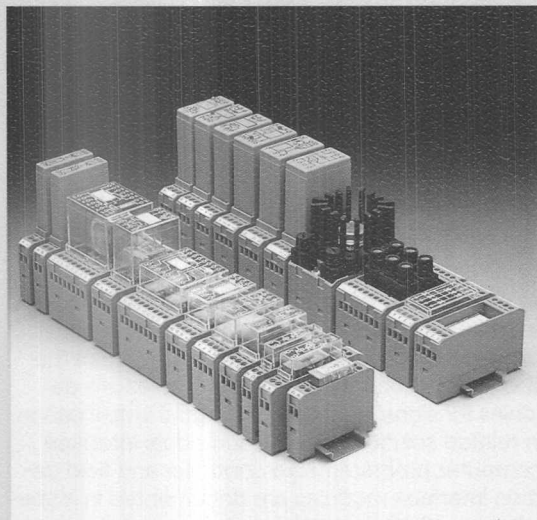
The MCR range offers approx. 30 different analog interface modules to condition, convert and isolate analog signals occurring in industrial measurement technique and control engineering. The module electronics is integrated in a modular rail-mounted housing mounting directly on all DIN-EN mounting rails inside the switching cabinets. The MCR range has available:

- Modules for isolating all standard measuring signals (current and voltage) to avoid data distortion caused by ground loops.
- Modules for floating conversion of standard signals e.g. current signals into voltage signals and vice versa.
- Modules which transform analog signals into equivalent digital data and vice versa.

The modular analog interface modules allow easy connection of individual signal circuits and loops to standardized I/O modules of automated systems.

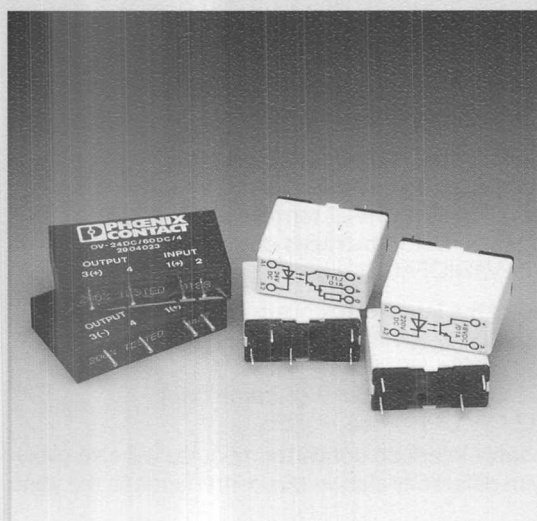


SELECTOR GUIDE



Electronic Modules EM

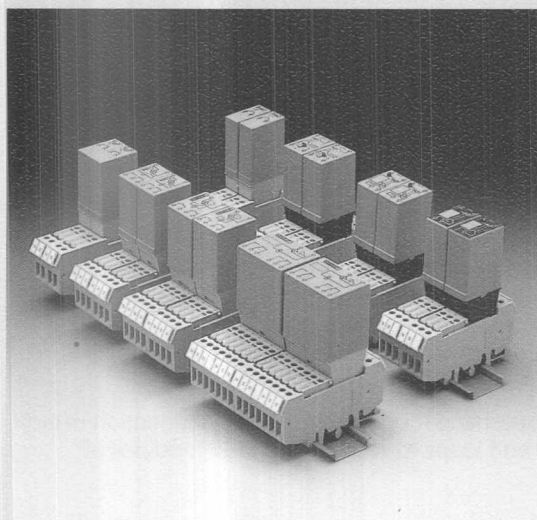
The EM-range provides auxiliary and adapter functions for control systems. The modules are offered in compact housing design and are available in sizes of 10 mm to 150 mm. A wide module range with all important interface functions for direct signal coupling between process and electronics can be supplied. The finished adapter function modules, designed as relay or optocoupler interfaces, as current monitoring modules, as diode and varistor modules mount directly to every DIN EN mounting rail.



Miniature Optocoupler

Solid State Relays

The miniature optocouplers SIM-EI are connection compatible with and have the same housing size and shape as that of commercially available electromechanical miniature switching relays! The miniature optocoupler pin compatibility with mechanical relays allow for direct electronic relay integration into existing circuitries, without modifications to the layout. The opto-relays switch circuits from the TTL-level to 220 V and offer a galvanic isolation of up to 4 kV. Solid-state-relays for switching currents up to 3 A supplement the existing product line.



Relay Terminal Blocks/Optocoupler Terminal Blocks

The relay/optocoupler terminal blocks designed for all typical interface functions provide:

- Installation of a modular, pluggable interface.
- Floating signal conversion of process messages and control commands.
- Noise elimination from input signals.
- Protection circuitry and function display in access circuits.
- Signal disconnection directly on the terminal strip.

The interface terminal blocks are provided with a rail-mountable base and the plug which contains all function elements. Relay terminal blocks are available in 2, 3, 4 and 7 position design with electromagnetic or electronic relay functions.